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SAN DIEGO BAY, A REVIEW, BENEFICIAL
USES WASTE DISPOSAL PRACTICES, WATER
QUALITY

Irving M. Terzich

Public Health Service
San Francisco, California

June 1965

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CALIFORNIA

A REVIEW

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WATER QUALITY

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Sanitary Engineer

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Division, Water Supply and Pollution Control
United States Public Health Service
Department of Health, Education and Welfare
Region IX
San Francisco, California

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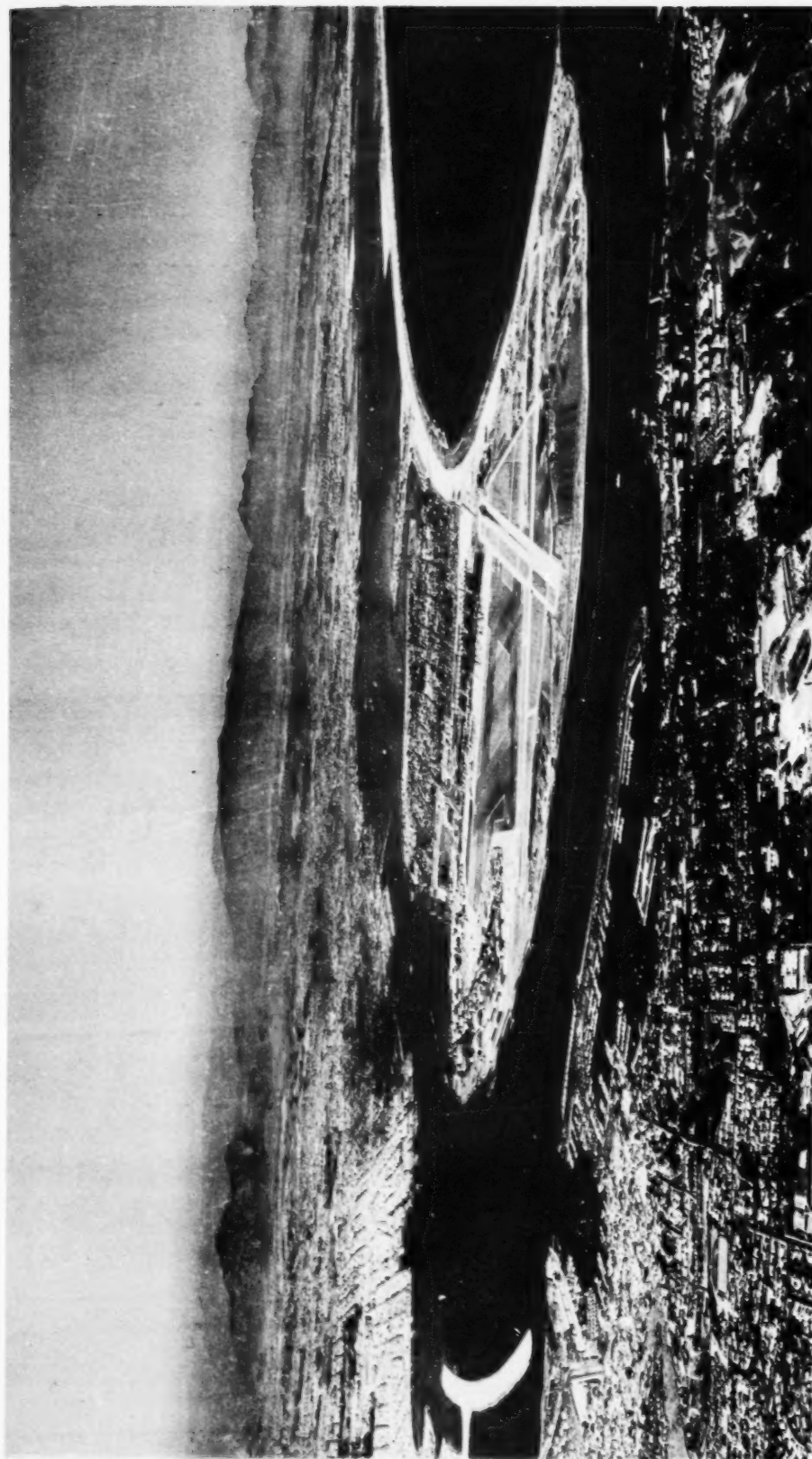
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SAN DIEGO BAY -- The dominant factor in the growth and economic well-being of the San Diego Metropolitan Area.

Photo Credit: Port of San Diego Unified Port District



ACKNOWLEDGMENTS

The compilation of data and background material for this review of beneficial uses, waste disposal practices and water quality of San Diego Bay has been a cooperative effort. Although the writer had the responsibility of drafting this presentation, the help of many individuals and organizations becomes apparent as this narrative of the Bay unfolds.

Of particular assistance were the administrative and technical staff members of the San Diego Regional Water Pollution Control Board -- specifically Dennis A. O'Leary, Executive Officer; Leonard Burtman, Senior Water Pollution Control Engineer; and Ladin H. "Red" Delaney, Assistant Sanitary Engineer. Their "facts and figures" and intimate knowledge of the history of water pollution control activities for the area, made it possible to prepare the review.

Through the cooperation of the United States Navy, and Assistant for Sanitary Engineering, SOWESTDIVDOCKS, Arthur M. Caldwell in particular, valuable waste disposal data on Navy's "floating population" was made available. Personnel of the United States Coast Guard Air Station, San Diego, provided the same data for their vessels.

The San Diego Chamber of Commerce and the San Diego Unified Port District provided a great deal of the general background material used to support the presentation.

SUMMARY AND RECOMMENDATIONS

Summary

In response to a Resolution from the California State Water Quality Control Board on the need for field studies of the effects of raw waste discharges from ships and vessels upon harbors and coastal waters; the development, practical demonstration and installation of shipboard and dockside devices which will preclude the discharge of raw wastes; and adoption of sewage disposal criteria for vessels, the Federal Water Pollution Control Advisory Board adopted Resolution No. 1, "DISCHARGE OF WASTES FROM SHIPS," April 17, 1964. This Resolution acknowledged the danger to health and welfare of the people from the discharge of untreated wastes from ships in United States ports.

The California Board noted the dearth of reliable data available on the effects of waste discharge from vessels, and suggested San Diego Bay, California, was ideally suited as a laboratory in which to conduct an investigation on this problem. The Public Health Service requested the Division of Water Supply and Pollution Control, Region IX, to document the beneficial uses, waste disposal practices and water quality of the Bay and report these factors to the Advisory Board.

This review traces the history of waste disposal practices in the San Diego Bay Area from the inception of the first collection system to the advent of the new treatment plant at Point Loma. The desecration of the Bay by three-quarters of a century of waste loadings is documented. The remarkably rapid recovery of water quality, once sewage waste loadings were discontinued, is also cited.

Since Southern Californians, and San Diego Area residents in particular, are avid aquatic sportsmen, many water-oriented beneficial uses are protected by waste disposal requirements. These beneficial uses, and the effects upon them by waste disposal practices, are reviewed in detail.

In digesting the accumulated data, several pertinent facts emerge:

- (1) San Diego Bay has regained its eminence as a natural resource through a community-action, water pollution control program;
- (2) untreated wastes from vessels are the only domestic sewage wastes currently discharged to the Bay;
- (3) there is painfully little reliable data on the effects of untreated vessel wastes on receiving waters;

- (4) there is a need for a study to suggest the solutions to vessel waste problems that are applicable nation-wide;
- (5) this study should be conducted in restricted marine waters subject to a minimum of interference by other pollutional problems;
- (6) San Diego Bay, California, meets these requirements and is eminently suited as a location for the study; and
- (7) an ecological investigation of San Diego Bay is needed.

Based on an evaluation of data made available by local, State and Federal agencies, two recommendations are presented for review by the Federal Water Pollution Control Advisory Board.

Recommendations

- (1) The United States Public Health Service should sponsor a study of all aspects of water pollution caused by the discharge of untreated wastes from vessels. Since the volume of these wastes is greatest at vessel concentrations such as harbors, ports, bays and estuaries, it is desirable to conduct the study in restricted marine waters subject to a minimum of interference by other pollutional loadings. San Diego Bay, California, meets these requirements and is eminently suited as a location for the study.

The study should be of such direction and scope as to suggest solutions to vessel waste problems that are applicable nation-wide. The investigation should not be limited to determining the effects of vessel waste loadings on the receiving waters, but should also develop a method or methods of disposal which will protect the water quality of the marine environment.

- (2) An ecological investigation of San Diego Bay should be made in conjunction with the study on vessel wastes. This will provide baseline data on which to evaluate the effectiveness of water pollution control activities in general, and the control of waste discharges from vessels in particular.

INTRODUCTION

The water quality of San Diego Bay has evoked serious civic discussion since the early 1940's. By 1941 the discharge of untreated domestic and industrial wastes by Bay communities was degrading water quality -- and interfering with many of the beneficial uses of the Bay's waters.

The City of San Diego, recognizing the need for leadership in a "core" program of waste disposal for the San Diego Bay community, constructed the first major sewage treatment plant in 1943. Although the plant was expanded in 1950, the rapid and unforeseen growth of the area brought premature obsolescence to the treatment system -- and water quality degradation with it. By 1958 most beneficial uses of Bay waters were again seriously impaired.

With the inception of the San Diego Metropolitan Sewerage System in August 1963, essentially all domestic sewage waste discharges were eliminated from the Bay. The recovery of Bay waters was dramatic -- in less than a year a virtual marine desert was transformed to an environment that abounded with all forms of aquatic life. San Diego Bay once again became an aesthetic resource for the people of the community and the thousands of visitors attracted to the area.

Exclusion of domestic wastes from the Bay focused attention on one of the largest single types of waste discharges remaining -- untreated wastes from vessels. Under consideration since 1952, each investigation of the quality of Bay waters has suggested vessel wastes were a contributing, but unknown, factor in the total scope of water pollution. Very little definitive data was available by which the extent of the problem could be assessed.

Expectedly, the San Diego Regional Water Pollution Control Board intensified its efforts to determine the pollutional effect of these discharges on the quality of water in San Diego Bay. Since the United States Navy was the largest single entity operating vessels on the Bay, the Board directed its efforts toward this Federal agency -- not unmindful, however, of the wastes being discharged to the Bay by merchant marine, both of U. S. and foreign registry.

Concurrent exchanges of correspondence between the Board; Southwest Division, Bureau of Yards and Docks, U. S. Navy, San Diego, California; and the U. S. Public Health Service, Region IX, San Francisco, California, covered the period from late 1959 to early 1964. The substance of these communications was information of a general nature -- basically concerned with the establishment of a Committee on Sewage and Waste Disposal From Vessels in Washington, D. C. This inter-agency

Committee was to study the whole complex field of vessel wastes -- and suggest methods by which disposal could be affected without pollution of coastal or harbor waters. Representatives from the Departments of Defense (NAVY), Commerce and Treasury, the jurisdictional agencies for U. S. Maritime and Naval vessels, serve on the Committee. The Chairman is from the Division of Environmental Engineering and Food Protection, Public Health Service.

As of February 1964, the Committee had proposed an amendment to the Interstate Quarantine Regulations, Public Health Service, to control the discharge of vessel wastes to coastal and inland waters of the United States. The U. S. shipping industry, in reviewing the proposal, indicated they were not opposed to the principle of abating water pollution, but they were strongly opposed to the approach taken by the Committee -- enforcement of the regulation being applicable only to vessels of U. S. registry. As yet the Public Health Service has not adopted the proposed Regulation.

Aggressively pursuing the vessel wastes problem, the San Diego Regional Water Pollution Control Board adopted Resolution 64-7 (Appendix), "A RESOLUTION REQUESTING THE STATE WATER QUALITY CONTROL BOARD TO MEMORIALIZE THE WATER POLLUTION CONTROL ADVISORY BOARD OF THE UNITED STATES DEPARTMENT OF HEALTH, EDUCATION AND WELFARE CONCERNING SEWAGE AND WASTE DISPOSAL FROM VESSELS," on February 27, 1964. This Resolution reviewed the success with which San Diego Bay communities had terminated municipal waste discharges to the Bay -- and noted the only remaining source of untreated sewage wastes to the Bay was from ships and vessels, notably those of the United States Navy. The Board pointed out the,

"... need for field studies of the ... effects of raw waste discharges from ships and vessels upon harbors and coastal waters; ... the development, practical demonstration, and installation of shipboard and dockside devices which will preclude the discharge of raw wastes ... adoption of sewage disposal criteria for vessels ... San Diego Bay is ideally suited for (such) field studies"

On April 8, 1964 the California State Water Quality Control Board adopted Resolution 64-6 (Appendix), "CONCERNING THE PROBLEM OF WASTE DISPOSAL FROM SHIPS," and directed William E. Warne, Director, California Department of Water Resources (member of the State Water Quality Control Board and the Federal Water Pollution Control Advisory Board), to bring this matter to the attention of the Federal Board. Subsequently the Federal Water Pollution Control Advisory Board

adopted Resolution No. 1 (Appendix), "DISCHARGE OF WASTES FROM SHIPS," April 17, 1964, calling upon the Secretary of Health, Education and Welfare,

"... to take cognizance of the situation ... and to use his good offices in soliciting the cooperation of the Department of the Navy, the United States Coast Guard and the United States Maritime Commission in joint efforts to eliminate this hazard."

Under provision of Section 9, Federal Water Pollution Control Act (Cooperation to Control Pollution From Federal Installations), and at the request of Robert E. Jones, Chairman, Natural Resources and Power Subcommittee on Government Operations, House of Representatives, the Enforcement Section, Division of Water Supply and Pollution Control, Region IX, Public Health Service, conducted field surveys of selected Federal installations during 1964. Included in these surveys were several U. S. Navy sites in the San Diego Bay area.

In submitting reports on these installations to the Commandant, Eleventh Naval District, a discussion of the discharge of untreated wastes from Naval vessels to San Diego Bay was included. This discussion led to the recommendation:

"... The effect of waste water discharges from vessels on the quality of physically restricted, onshore waters is a water pollution control problem which transcends current conditions at San Diego Bay. It is recognized as a problem of national scope which should be approached by a thorough and scientifically conducted engineering investigation studying all aspects of harbor pollution.

"The investigation should identify the part untreated vessel wastes play in harbor pollution, define the magnitude of it, and provide direction and scope to planning corrective action. It is recommended Navy support and actively participate in a nation-wide project, any phase of which might be undertaken within the Eleventh Naval District."

In his reply, Admiral L. C. Coxe, Director, Southwest Division, Bureau of Yards and Docks stated,

"... SOWESTDIVDOCKS would support a research project of this nature and would certainly welcome the opportunity to participate in any phase of it that might be undertaken within the Eleventh Naval District."

This Review of the beneficial uses, waste disposal practices and water quality of San Diego Bay will place vessel wastes in a proper perspective with the program for protection of the total marine environment.

SAN DIEGO BAY

General Description

San Diego Bay is located on the coast of Southern California with the entrance at latitude $32^{\circ} 40' N$ and longitude $117^{\circ} 14' W$. The Bay, a crescent shaped basin (see Frontispiece) about fifteen miles in length and from one quarter to two and one-half miles in width, is the dominant factor in the growth and economic well-being of the area. The natural harbor is protected on the west by the high ground of Point Loma; it is separated from the Pacific Ocean by a low-lying sand spit called the Silver Strand which terminates at the northern end in the North Island Naval Air Station. The complex of communities which line the twenty-five miles of shoreline make up the southernmost urbanized area of the populous State of California. The combined populations of the core city of San Diego and contiguous cities was 417,239 in 1950; by 1960 the area expanded to 784,416; the estimate for 1965 was 860,817.

The Portuguese navigator Juan Rodriguez Cabrillo entered San Diego Bay on September 28, 1542, claiming the region for Spain -- and named the site of his landing, San Miguel. Sixty years later, on November 10, 1602, the Spanish explorer Sebastian Vizcaino arrived and renamed the spot San Diego. It was not until 1769, however, that Father Junipero Serra of the Franciscan Fathers dedicated the first of the famous California Missions (Mission San Diego de Alcala) at the site now known as Old San Diego. Don Gaspar Portola became the first governor and San Diego Bay began its career as a harbor. The United States first gained possession of the area on July 29, 1846.

WATER POLLUTION CONTROL

In 1949 the California Legislature made comprehensive changes in the laws of the State for the control of water pollution. In that year the Water Pollution Control Act (1) was added to the California Water Code. This Act introduced three new concepts of water pollution control:

- (1) placed the responsibility for the prevention and control of pollution at the local (regional) level;
- (2) emphasized the necessity for greater consideration of the economic effects of sewage and industrial wastes; and
- (3) provided for the coordination of the many interests involved in over-all waste disposal and water quality problems.

Known as the Dickey Water Pollution Act, it created nine local Boards to be appointed by the Governor on a regional basis -- and provided that the appointees be representative of five major interests:

- (1) water supply, production or conservation;
- (2) irrigated agriculture;
- (3) a waste producing industry;
- (4) municipal government; and
- (5) county government.

In 1959 a legislative amendment added two additional Board members representing:

- (1) recreation and wildlife, and
- (2) the public at large.

The San Diego Regional Water Pollution Control Board, originally consisting of five local persons appointed by Governor Earl Warren in late 1949, now has a full complement of seven members representing the interests stated above. The Board conducts its business at regular public meetings which must be held at least once each calendar quarter. Administrative and technical support for the San Diego Board is supplied

by an executive officer, two water pollution control engineers, a secretary and a clerk-typist. The San Diego Region comprises all basins draining into the Pacific Ocean between the southern boundary of the Santa Ana Region (a line running generally east and west from Corona del Mar, Orange County, to Anza, Riverside County), and the California - Mexico boundary.

California has gained national recognition for the accomplishments of its water pollution control program and the techniques by which this program is administered. The stated philosophy of the San Diego Board is, "... that only through full, open discussion (at Board meetings) and widespread knowledge and interest can the people of this region be assured of a pollution control program consistent with their over-all best interests."

BENEFICIAL USES AND LONG-RANGE PLANS
AND POLICIES FOR WATER QUALITY PROTECTION -- SAN DIEGO BAY

General

Under Section 13052 (e), Article 2, Chapter 4, Water Pollution Control Act (1), a Regional Board is empowered to:

"Formulate and adopt long-range plans and policies with respect to water pollution control within the region in conformity with the policies set forth in Chapter 1 (commencing at Section 13000)."

In referring to Section 13000.2, Chapter 1, State Policy, we find:

"The Legislature finds and declares that, because of the widespread demand and need for the full utilization of the water resources of the State for beneficial uses, it is the policy of the State that the disposal of wastes into the waters of the State shall be so regulated as to achieve highest water quality consistent with maximum benefit to the people of the State and shall be controlled so as to promote the peace, health, safety and welfare of the people of the State."

Again, Section 13000.4, Chapter 1, State Policy, declares:

"The Legislature finds and declares that, because of the widespread demand and need for the full utilization of the water resources of the State for beneficial uses, maintenance of water quality is a matter of statewide interest and concern."

Then Section 13005, Chapter 2, Definitions, indicates:

"'Pollution' means an impairment of the quality of the waters of the State by sewage or industrial waste to a degree which does not create an actual hazard to the public health but which does adversely and unreasonably affect such waters for domestic, industrial, agricultural, navigational, recreational or other beneficial uses, or which does adversely and unreasonably affect the ocean waters and bays of the State devoted to Public recreation."

On April 8, 1955 the San Diego Regional Water Pollution Control Board adopted Resolution 55-1, "A RESOLUTION ENUNCIATING THE BENEFICIAL USES OF SAN DIEGO BAY WATERS TO BE PROTECTED AND ADOPTING WATER QUALITY CRITERIA PERTAINING THERETO." In this Resolution the Board recognized:

"... The formulation of such plans and policies involves the determination of the beneficial water uses to be protected from pollution, of the water quality which must be maintained to protect said uses, and of the extent to which waters can be utilized for disposing of sewage and industrial wastes"

Accordingly the Board set forth existing and potential uses of San Diego Bay for which water quality was to be protected.

NOTE: Underlines in above quotations have been provided by the writer.

Beneficial Uses

In presenting the significant uses of San Diego Bay established by the Board, a brief review of activity associated with the use is desirable. Where possible, data for the time span 1951-1964 has been selected. This will allow comparison with water quality data available for this period.

Beneficial uses of San Diego Bay are:

(1) Maritime

San Diego Bay, one of the ten great natural harbors of the world and one of the three natural deep-water harbors on the Pacific Coast, occupies a position of prime importance in West Coast military and commercial maritime activity. Maritime use of the Bay includes commercial and naval shipping, mooring, berthing, navigation and the building and repair of vessels.

(A) Commercial

San Diego Unified Port District, successor to the Harbor Department, City of San Diego, was established in December 1962. The District administers three basic services to the community:

- (a) maritime commerce,
- (b) air terminal management, and
- (c) tideland development.

Directly related to the use of Bay waters is the commercial maritime traffic serviced by the Port. This can best be illustrated by listing the direct revenue tonnage and number of vessels serviced by the District.

Date	Tonnage	Ship Calls
1952	68,104	---
1953-54	125,148	130
1954-55	166,281	173
1955-56	236,085	201
1956-57	240,870	259
1957-58	295,593	329
1958-59	396,459	430
1959-60	475,252	490
1960-61	478,815	532
1961-62	470,589	608
1962-63	531,754	780
1963-64	880,399*	644*

A Master Plan for the Port District was adopted in January 1964. The Plan looks to expansion in the South Bay, programming a total of four marine terminals on tidelands for the area. Also included are marinas, small-boat launching ramps and provision of large tideland tracts for industrial development.

An early project will be the marine terminal at National City; a deep-water channel may eventually connect South San Diego Bay with the sea, providing

*Provision of the Port's first high-speed bulk cargo handling facility accounted for a good portion of the 67 per cent increase in tonnage. The completion of an oil pipeline from oil production centers north of San Diego, to the City, reduced number of ship calls formerly engaged in transportation of petroleum products

a second entrance for the harbor as a whole. As the Master Plan is implemented, San Diego Area officials confidently predict large increases in commercial ship traffic.

(B) United States Navy

The United States Navy first appeared in San Diego Bay well over a century ago. Navy installations have grown steadily since that time, until, today, they occupy thousands of acres and represent an investment of over 1.2 billion dollars. From an inauspicious beginning with the arrival in 1842 of the USS ALERT, Navy presently swells the economy of San Diego by an estimated 750 million dollars a year. There are normally 140,000 Navymen serving on ships and shore stations -- with retired personnel and dependents considered, Navy-oriented persons make up more than a quarter of San Diego County's population.

San Diego Bay is "home" for the following major Navy Commands and the activities for which they are responsible:

- (a) United States First Fleet, charged with defending the western shores of the United States;
- (b) Headquarters, Eleventh Naval District, directing all shore stations in nine southern California counties, Clark County, Nevada, and the State of Arizona;
- (c) U. S. Naval Station, comprising three Commands, Marine Barracks, Service Schools and Commissary Store;
- (d) Naval Training Command, which has trained over 1.5 million Navymen;
- (e) Commander Naval Air Force, Pacific Fleet, providing Naval aviation for the entire Pacific;
- (f) Commander Amphibious Force, U. S. Pacific Fleet, providing the basic amphibious capability of the Pacific Fleet;

- (g) Commander Cruiser - Destroyer Force, U. S. Pacific Fleet, furnishing trained, combat-ready ships to the U. S. Seventh Fleet;
- (h) Commander Service Group One, Pacific Coast headquarters for Pacific Fleet Service Force;
- (i) San Diego Group, Pacific Reserve Fleet, having responsibility for 219 reserve ships; and
- (j) Commander Submarine Flotilla One, controlling all Eastern Pacific submarines.

The casual visitor to San Diego Bay is impressed with the readily apparent activity of Navy craft in the central and north portions of the harbor. But even local residents are awed by the vast numbers of vessels Navy may have berthed or moored in the deep water areas of the Bay. Five of the ten Commands listed above, operate the majority of surface and underwater vessels. They are:

- (a) Service Group One
- (b) Cruiser - Destroyer Pacific
- (c) Naval Air Force Pacific
- (d) Amphibious Pacific
- (e) Submarine Flotilla One

The complexity of Naval operations makes a forecast of the numbers of Navy ships in San Diego Bay at any one time hazardous. Some general estimates of what might be expected are presented in Table A. The presence of larger ships, such as aircraft carriers and cruisers, in the Bay at the same time may be limited by the availability of mooring or berthing facilities.

TABLE A

ESTIMATE OF SHIP TYPE, NUMBER AND COMPLEMENT
UNITED STATES NAVY CRAFT
SAN DIEGO BAY

Command	Type of Ship	Number of Ships	Complement	Remarks
Service Group One	AR (Large)	1	550)	These vessels rarely leave an assigned port.
	AR (Small)	1	525)	
	ATF	10	70	Used for salvage and towing.
	MAP	15-20/year	70-80	Various types of craft on transfer to foreign governments.
	AO	Varies	220	) These units are transient vessels using San Diego Harbor on constantly changing schedules.
	AZ	Varies	210	
	AF	Varies	210	
Cruiser-Destroyer Pacific	CL)	5	1500)	) Not more than two vessels of these classes in port at any one time.
	CLG)			
	DLG)		350)	
	DDG)		320)	An average of 16 of the combined types in port at any one time.
	DD)	54	235)	
	DE)		160)	
	DER)		160)	
	AD	3	1000	Estimated 1.5 units in port at any one time.

TABLE A (continued)

Command	Type of Ship	Number of Ships	Complement	Remarks
Naval Air Force Pacific	CVA	5	2628	Super Aircraft Carrier (Tactical) Kitty Hawk Class. With air group aboard, complement is 3653. No more than 4 of combined CVA and CVS in port at any one time -- limited by berthing facilities; with anticipated berthing expansion, 4 more units, including cruisers, could be accommodated.
	CVS	0	1930	Support Carrier Hornet Class. With air group aboard, complement is 2674.
	AV	2	651	Aviation Repair Ship (Seaplane Tender) Pine Island Class. Can expect two in port at one time.
	AGC)		682	Amphibious Command Ship With Flag group aboard, complement is 893
	AKA)		366	Attack Cargo Ship
	APA)		526	Attack Transport Ship With Flag group aboard, complement is 584
	APD)	46	208	Converted Destroyer Type
	LPD)		439	Combination Transport-Landship Dock An average of 25 vessels of combined types in port at any one time.
	LPH)		532	Landing Platform, Helicopter
	LSD)		319	Landship, Dock
	LST)		115	Landship, Tank

TABLE A (continued)

Command	Type of Ship	Number of Ships	Complement	Remarks
Submarine Flotilla One	SS	24	80	Submarine-Diesel Powered Maximum of 12 in port at any one time.
	SSN	4	100	Submarine-Nuclear Powered Maximum of 2 in port at any one time.
	AS	2	958	Submarine Tender Two in port at all times.
	ASR	2	79	Submarine Tender (Reserve and Salvage) One in port at all times.

(C) United States Coast Guard

The United States Coast Guard has been associated with San Diego Bay since 1851 -- the year the Point Loma Lighthouse Station was placed in operation. Later, in 1890, an additional lighthouse station was activated at Ballast Point. In the early 1900's, the original Lifeboat Savings Station was established on the Bay proper.

Today Coast Guard operates and maintains four installations in the San Diego Bay area. The two light stations remain at Point Loma and Ballast Point. Search and rescue operations (sea and air) are headquartered at the San Diego Coast Guard Air Station -- it is from here the 125-foot cutter ALERT (28-man crew) and the two 95-foot patrol boats (Cape Newagen and Cape Jellison) are directed. The latter two ships have complements of 14 men each. Shore installations account for some 207 additional personnel.

(D) Building and Repair of Vessels

The building and repair of ships, both commercial and military, has expanded from a 6.5 million dollar industry in 1950 to in excess of 50.0 million dollars in 1964. Ranging in size from plants which can construct or repair a vessel the size of an aircraft carrier to those which can accomplish alterations on a fishing boat, some 20 firms are scattered throughout the San Diego Bay area. With the closing of the U. S. Naval Repair Facility in July 1964, commercial shipbuilding and repair has taken on added importance for San Diego Bay communities.

(2) Industrial

Specific marine-oriented industries which either use San Diego Bay waters or discharge wastes thereto are established along the shoreline of the Bay. These fall in the general categories of fish canneries; a kelp processing plant; a fish and animal by-product reduction plant; a salt and chemical operation in the extreme south end of the Bay; and an oil separation unit operated by the San Diego Unified Port District. In addition, power generation facilities and other industries use water from the Bay for condenser cooling purposes.

(A) Fish Canneries

Fish cannery operations in the San Diego Bay Area are oriented to the processing of tuna caught by 1400 fishermen operating a 100-boat fleet out of San Diego. Five canneries processed some 4.0 million cases during the 1950-51 season; a single plant packed 1.5 million cases for the 1963-64 season. An industry spokesman feels San Diego could now support an additional cannery.

A fish cannery is a combination consumer of, and a discharger to, Bay waters. Frozen tuna arriving in the fish wells of the boat must be partially thawed to facilitate removal. The fish are then placed in flumes filled with sea water for transportation from the tuna boat to the shore-side processing plant. Here the partly thawed fish can be (not always) placed in holding tanks for additional thawing before entering the cutting room. Water is pumped from the Bay for all of these operations.

(B) Kelp Processing

Kelp processing is a unique industry. It is invariably located only where an adequate, economical source of kelp is available. Since such a kelp supply is found in onshore Pacific Ocean waters at San Diego's latitude, the San Diego Bay Area is a natural location for this industry.

In processing kelp, the raw product is brought to the plant dock in barges and unloaded into large hoppers. In the plant it is chopped and washed with Bay water to remove excess salts and plant sugars. Chopped kelp is then digested in a hot sodium bicarbonate solution. The digested mass is placed in large filters for the recovery of sodium alginate. An additional liquid phase in processing uses treatment with lime -- evolving the final product, algin.

(C) Fish and Animal Reduction

In fish and animal reduction, solid and liquid wastes from fish canneries, and solid wastes of animal origin, are processed for oil and grease -- remaining

solids are dried and converted to chicken feed. Animal entrails originally washed with Bay water are now flushed with fresh water; a cooker and drier fumes washer is operated with water from San Diego Bay.

(D) Salt and Chemical Production

Extensive acreage in South San Diego Bay is devoted to the production of salt from Bay water by solar evaporation. From 65 to 70 thousand tons of salt are produced each year; further processing of the bittern produces magnesium chloride at a rate of 150 to 300 tons per month.

(E) Oil Separation Unit

The San Diego Unified Port District operates an oil separation unit at its Tenth Avenue Marine Terminal for processing ballast and bilge water of ships using District facilities. Although the unit has a design capacity of 1.0 mgd, use has been intermittent and far below that anticipated.

(F) Condenser Cooling

Power generation facilities make up the major industrial use of Bay water for condenser cooling. Most of the processing operations described in this section also draw large quantities through their plants for cooling purposes.

(3) Aquatic Recreation

Aquatic recreation embraces the many water contact sports enjoyed by residents of coastal zones in California.

San Diego Bay is admirably situated climatewise to make aquatic recreation a major community activity. One national magazine credits San Diego with, "... the finest climate in the United States." With sunless days (353 days of sunshine per year) a rarity, and where only a 14-degree difference between the average high temperature in the coldest and warmest months

exists (mean annual temperature of 61.5° F), the description is readily believable. An average annual rainfall of 10 inches coupled with minimum wind velocities, (averaging 8 to 9 miles per hour), add to the near perfect climate picture. It is no wonder then that aquatic recreation, through all types of water contact sports, is a "way-of-life" in the San Diego Bay Area. These include:

(A) Swimming, Bathing and Wading

Silver Strand and Shelter Island are San Diego Bay's major areas for swimming, bathing and wading; although fewer people use the facilities of the San Diego Rowing Club and the shoreline bordering Harbor Drive, these areas also attract many families seeking these water contact activities.

Visitor use at Silver Strand State Park, an area ideally suited for family-type outings involving swimming or wading, was estimated at from 500 to 5000 persons per day at the height of the summer season of 1951. Recent visitation figures at the Park for 1957-1964 are listed below:

<u>Year</u>	<u>Visitors Per Year</u>
1957	249,000
1961	275,000
1963	350,000
1964	290,000

Despite the congestion of small boats in Yatch Harbor at Shelter Island, a good deal of swimming takes place along the excellent beaches -- estimates placed 700 swimmers per day in the area in 1951. Although comparative figures for the period 1960-1964 are not available, extensive development of the Shelter Island area since 1951 indicates a considerable increase in swimming and wading activity has taken place.

With the construction of Harbor Island in 1962, the shoreline along Harbor Drive became more attractive for family recreation. Visitor use figures for this portion of the Bay are not available.

(B) Beach and Tide Pool Exploration

Exploration of beach and tide pool areas is an activity in which many residents of coastal communities engage at one time or another. Since this recreational endeavor is enjoyed over a considerable geographic area of Bay shoreline, data on the number of persons involved each year are not recorded.

(C) Waterskiing and Similar Boat-Towed Activities

Waterskiing and similar boat-towed activities are concentrated in two areas:

(a) near Harbor Island, North San Diego Bay, and

(b) large sections of the entire South Bay.

San Diego Bay and nearby Mission Bay are the only large, protected bodies of water in this part of Southern California for boat-towed water contact sports. The extensive water surface needed for this sport makes it difficult to estimate the number of persons enjoying the activity.

(D) Boating

This category of aquatic recreation activity includes classes of boat and vessel use which were not covered in the description of commercial and naval maritime operations.

San Diego County can claim almost 10 per cent of California's 210,000 pleasure craft. Within cruising or easy trailering range, however, there are an additional 50,000 craft. Registrations (or estimates) for 1950-1965 are as follows:

<u>Year</u>	<u>Number of Craft</u>
1950	2,300
1955	4,000
1960	13,500
1965	19,000 (E)

Pleasure craft operate out of marinas at Shelter Island, Glorietta Bay, San Diego Rowing Club, and a launching ramp on Harbor Island. San Diego Unified Port District has plans for the construction of a permanent marina at Harbor Island and several boat launching and marina facilities in the South Bay.

Although use figures for some categories of aquatic recreation are difficult to document, it has been conservatively estimated there were 300,000 persons per year engaged in these recreational pursuits in 1955. Since the attendance at a single beach (Silver Strand State Park) for 1963 exceeded this amount, the total current use of San Diego Bay waters for water contact sports may be in excess of 500,000 persons per year.

(4) Fish and Wild Life

Fish and wild life use of the Bay covers a variety of activities. These include:

(A) Operations and Berthing of Commercial Fishing Boats

Although there is a stable core of commercial fishing boats which claim San Diego Bay as their home port, as many as 2000 commercial craft utilize the Bay as their home base during the summer albacore run.

(B) Party Boats

These craft charge a customer fee for taking fishermen into the Bay or out to the Pacific Ocean for sport fishing. Based at the commercial boat basin near Shelter Island, they conveyed some 85,000 persons to fishing areas in 1955; current use involves 43 boats in which 101,600 sportsmen caught 578,604 fish of various types.

(C) Tuna Purse Seiner Fleet

The tuna fleet, operating out of San Diego Bay, employs 1400 men on 100 purse seiners. This local fishing fleet accounts for more tuna than any

other port in the world -- about 45 per cent of the entire catch.

(D) Fishing, Clamming and Hunting

From the time of the founding "padres", San Diego Bay has been the home of countless species of wild life -- water fowl, both migratory and nonmigratory; salt marsh shore birds; shellfish, bait fish and many varieties of sport fish. The abundance of wild life attracts thousands of persons to the Bay and its shoreline to pursue fishing, clamming and hunting as recreational activities. A public fishing pier is provided at Shelter Island for shore-bound sportsmen.

(E) Fish and Wild Life Propagation and Preservation

The protected waters of onshore marine areas have historically been the rearing, feeding and preservation grounds for many species of fish and wild life. The shallow, shoreline waters of San Diego Bay are an excellent example of an abundant environment for the preservation of water fowl, forage fish species and certain small species of marine fish. Aside from the commercial value of some species, other species are part of the aquatic food chain supporting the larger forms of sport fish. Shallow marshland also provides protection for water fowl in all stages of development.

(5) Aesthetic Enjoyment

Residents and visitors alike are drawn to San Diego Bay by its beauty. A long and eventful Spanish heritage is reflected in residential architecture -- tiers of "Spanish style" homes overlook the Bay from the high ground forming the northwest shoreline. It is from here and other vantage points that the Bay fulfills its role as an aesthetic natural resource for the people of the surrounding communities -- as well as those who are there for but a brief visit.

Harbor craft conducted commercial sight-seeing tours allow visitors to view the Bay at close hand. Private boats are often utilized for leisurely cruises -- with no further purpose than to be more closely associated with the marine environment. A fine

day, and there are many of them, finds the Bay dotted with sailboats. The Bay, as an aesthetic asset, is firmly entrenched in community activities.

(6) Disposal of Sewage and Industrial Wastes

Prior to the establishment of regional water pollution control boards in California, it was accepted practice for communities to discharge the effluent from their sewage treatment systems to nearby surface waters. In some instances domestic sewage and industrial wastes were discharged, without treatment. When nuisances occurred, or the public health was threatened, one or more steps were taken to improve conditions:

- (a) sewage treatment plants were constructed to process untreated wastes,
- (b) existing treatment facilities were expanded to handle increased loadings,
- (c) treatment plant effluent was chlorinated, or
- (d) outfalls were extended to obtain greater dilution of wastes.

Both "positive" and "negative" benefits arise when domestic and industrial wastes, treated or untreated, are discharged to surface waters. The ability of a community to use the water as a dilutant for wastes is a positive benefit for the community. The discharge of these wastes to the watercourse is a negative benefit to the aquatic environment -- and eventually to any downstream or surrounding community.

There is probably an irreducible minimum of wastes, domestic or industrial, which must, for a variety of reasons, enter San Diego Bay. The communities along the Bay used this body of water extensively for receiving wastes prior to 1963 -- but by concerted action in eliminating wastes from the Bay, are approaching this irreducible minimum in 1965. The concept of using the assimilative capacity of Bay waters to the extent available has been discarded -- and replaced with a percept of keeping the waters of San Diego Bay as free from pollution as is possible.

Long-Range Plans and Policies for Water Pollution Control

In accordance with the Water Pollution Control Act, the San Diego Regional Water Pollution Control Board adopted a Resolution on

April 15, 1952, setting its general objectives with respect to the disposal of sewage in San Diego Bay. The Board supplemented these objectives by adoption of an additional Resolution (55-1), "A RESOLUTION ENUNCIATING THE BENEFICIAL USES OF SAN DIEGO BAY WATERS TO BE PROTECTED AND ADOPTING WATER QUALITY CRITERIA PERTAINING THERETO," on April 8, 1955. Plate I identifies the beneficial uses of the waters of San Diego Bay and the areas to be protected for these uses as presented in Resolution 55-1. Table I enunciates the water quality criteria to be applied to these beneficial uses.

Although Resolution 55-1 is currently in force for the waters of San Diego Bay, the Board, on April 22, 1965, determined a review and possible revision of the beneficial use protection policy and water quality objectives would be desirable. This determination was based on three factors:

- (1) a master plan for San Diego Bay recently adopted by the San Diego Unified Port District,
- (2) water quality objectives were established ten years ago, and
- (3) the remarkable recovery and improvement of water quality of the Bay -- and the need to assure a continuing quality of water at least as good as that existing at the present.

Accordingly the Board has asked for a Staff Report to support an evaluation of the existing resolution.

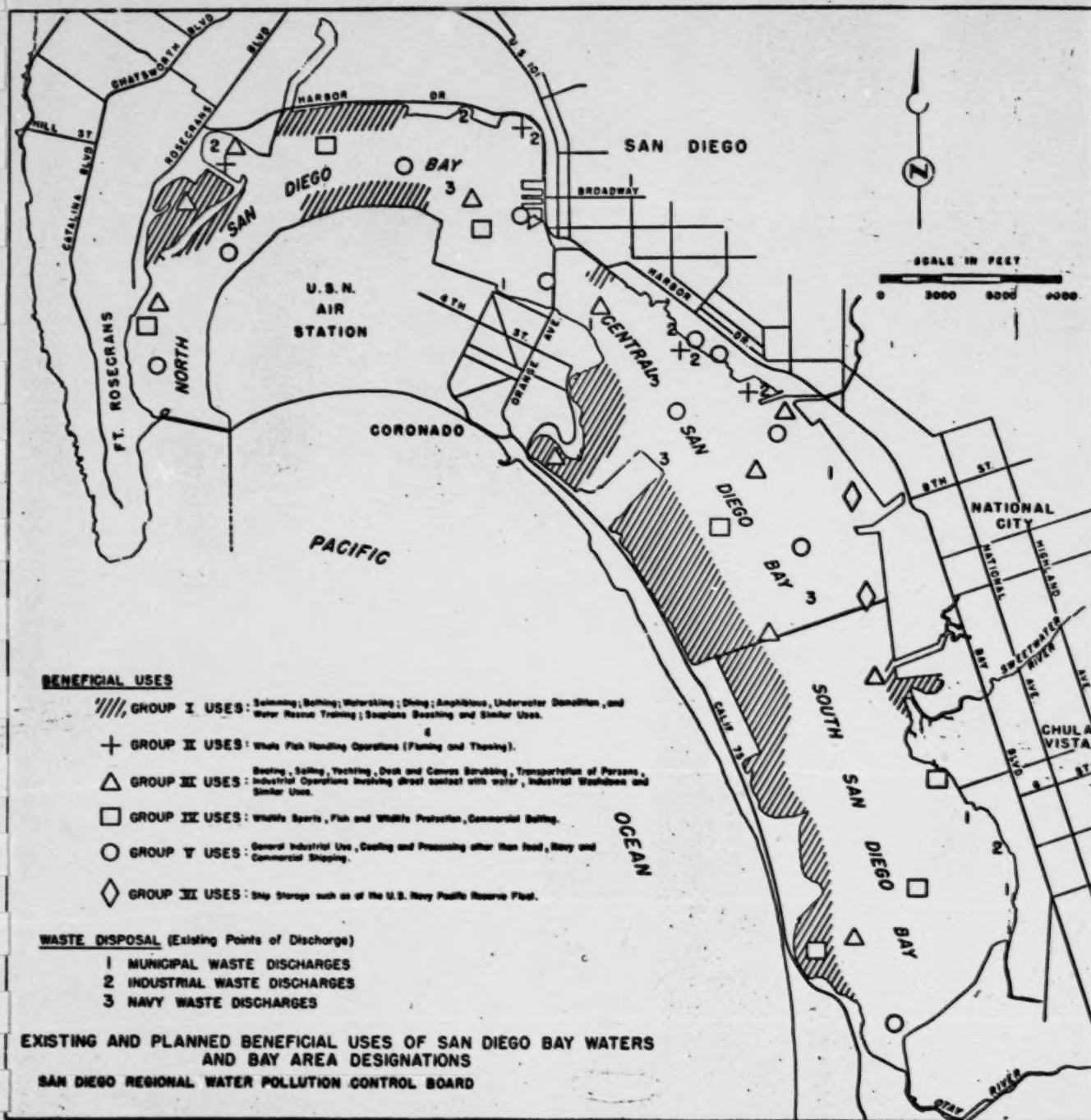


PLATE I

TABLE I

QUALITY CRITERIA APPLICABLE TO
THE BENEFICIAL USES OF SAN DIEGO BAY WATERS

BENEFICIAL USES

WATER QUALITY CRITERIA

GROUP I USES:

Swimming, Bathing and
Waterskiing
Diving
Amphibious, Underwater
Demolition and Water
Rescue Training
Seaplane Beaching
Other uses involving immersion

- The coliform density expressed as the MPN shall not exceed 10 per ml. in more than 20% of any 20 consecutive samples.
- Dissolved Oxygen not less than 4.0 ppm.
- pH between 6.0 and 9.0
- No floating solids, settleable solids, oil, grease, sludge deposits attributable to waste disposal.
- No noticeable odor, color or turbidity attributable to waste disposal.
- No toxic wastes or deleterious substances in amounts sufficient to make water unsafe or unsuitable for the purposes in this group.

GROUP II USES:

Whole fish handling operations
(Fluming and thawing)

-
- The coliform density expressed as the MPN shall not exceed 7 per ml. in more than 20% of any 20 consecutive samples.
 - Dissolved Oxygen not less than 2.0 ppm.
 - pH between 6.0 and 9.0
 - No floating solids, settleable solids, oil, grease, sludge deposits attributable to waste disposal.
 - No noticeable odor, color or turbidity attributable to waste disposal.
 - No toxic wastes or deleterious substances in amounts sufficient to make water unsafe or unsuitable for the purposes in this group.
-

TABLE I (continued)

BENEFICIAL USES

WATER QUALITY CRITERIA

GROUP III USES:

Boating, Sailing and Yachting
Deck and canvas scrubbing
Transportation of persons, food-
stuffs and water in small
boats by Navy and commercial
interests
Industrial and ship repair
operations involving direct
contact with water
Industrial washdown
Other similar uses involving
spray or direct contact
with Bay water

- The coliform density expressed as the MPN shall not exceed 10 per ml. in more than 20% of any 20 consecutive samples.
- Dissolved Oxygen not less than 2.0 ppm.
- pH between 6.0 and 9.0
- No floating solids, settleable solids, oil, grease, sludge deposits attributable to waste disposal.
- No noticeable odor, color or turbidity attributable to waste disposal.
- No toxic wastes or deleterious substances in amounts sufficient to make water unsafe or unsuitable for the purposes in this group.

GROUP IV USES:

Fish and wildlife sports
Fish and wildlife protection
Commercial baiting
Other similar uses

- The coliform density expressed as the MPN shall not exceed 10 per ml. in more than 20% of any 20 consecutive samples.
- Dissolved Oxygen not less than 4.0 ppm.
- pH between 6.0 and 9.0
- No floating solids, settleable solids, oil, grease, sludge deposits attributable to waste disposal.
- No noticeable odor, color or turbidity attributable to waste disposal.
- No toxic wastes or deleterious substances in amounts sufficient to make water unsafe or unsuitable for the purposes in this group.

TABLE I (continued)

BENEFICIAL USES

WATER QUALITY CRITERIA

GROUP V USES:

General industrial use
Cooling and processing
(other than food)
Navy and commercial shipping
Other similar uses

- Dissolved Oxygen not less than 1.0 ppm.
- No toxic wastes or deleterious substances in amounts sufficient to make water unsafe or unsuitable for the purposes in this group.
- pH between 6.0 and 9.0
- No offensive or detrimental odors, color or turbidity attributable to waste disposal.
- No objectionable suspended solids, oil or grease attributable to waste disposal.

GROUP VI USES:

Storage and preservation of
vessels assigned to the
San Diego Group, Pacific
Reserve Fleet, U. S. Navy
Other similar uses

- pH between 6.0 and 9.0
- Dissolved Oxygen not less than 1.0 ppm.
- No deleterious substances in amounts sufficient to make water unsafe or unsuitable for the purposes in this group.

WASTE DISPOSAL PRACTICES

SAN DIEGO BAY

General

During the first half of the Twentieth Century, many communities of the United States utilized the waste assimilation capacity of nearby surface waters as an easy and economical solution to their waste disposal problems. To the communities surrounding San Diego Bay, this large body of water, with a seemingly endless ability to receive and dilute wastes, was a "natural" depository for raw sewage, sewage treatment plant effluents, partially digested sludge and industrial wastes.

Domestic Wastes

The City of San Diego, by its physical eminence, dominates the San Diego Bay Area. Recognizing the need for leadership in a "core" program of waste disposal, the City has consistently led the way in seeking an adequate solution for the disposal of domestic sewage. In attacking the waste disposal problem, the City drew heavily on the waste assimilation capacity of San Diego Bay. By 1951 the Bay was receiving some 37.4 mgd of raw and treated domestic wastes. By far the largest amounts of these wastes originated with the City of San Diego and the communities served by the City sewage treatment system. Because this discharge, concentrated at the City outfall, was to exert a major detrimental effect on Bay waters, a history of the San Diego program is of interest. Other major discharges to the Bay will be mentioned briefly.

(1) City of San Diego

The California Gold Rush of the mid-Nineteenth Century brought enough additional people to San Diego to necessitate a sewage collection system by 1887-1888. A 40-mile network of collectors terminated in a raw sewage outfall discharging to the Bay. From the time of this first system of sewers, disposal of the collected waste was by dilution with waters of San Diego Bay -- or in some cases, the Pacific Ocean. Of the older cities in California, San Diego is unique in having had a completely separate collection system, for domestic wastes and storm runoff, since its inception. By 1941 there were twenty-two separate domestic waste outfalls serving the City -- nine of which emptied into the Bay.

That year (1941) the City of San Diego authorized the construction of the first major sewage treatment plant in the San Diego Bay Area. Perhaps prophetically, this new facility (14.0 mgd), placed in operation in June 1943, was destined to receive maximum design flows in the first year

after completion. Expansion of the treatment facilities was authorized in 1946, and in 1950 the expanded operation was servicing not only the City of San Diego but other nearby communities as well. Shortly thereafter, peak sewage flows again exceeded the design capacity of the expanded system. A stop-gap emergency chlorination program on sewage treatment plant effluent was placed in force in 1956.

As waste loads mounted, not only in the core city of San Diego, but throughout San Diego County as well, it became apparent the use of San Diego Bay as a dumping ground for waste effluents must end. Consequently in 1951 San Diego County retained a Board of Engineers to draft a county-wide sewerage plan. Caldwell, Hyde and Rawn, in submitting their report (2) in 1952, recommended,

"... removal of all community waste discharges from the Bay and discharge into the ocean through a unified system for the entire metropolitan area"

That same year the San Diego Regional Water Pollution Control Board, through Miller and Nusbaum (3), released a report which comprehensively explored the waste disposal problems of the Bay communities -- and the devastating effects on the aquatic environment resulting from past disposal practices. The writer has drawn freely from both of these publications to document this presentation.

With a defeated bond issue (1954) intensifying the problem, waste disposal to San Diego Bay entered an "emergency era". Subsequent engineering reviews of the waste disposal problem by Carollo, Koebig and Kennedy(4) in 1955; and Homes & Narver - Montgomery in 1958 (5), reiterated the inadvisability of further use of San Diego Bay as a discharge point for waste effluents. Again disposal of community wastes to the ocean through a unified metropolitan system was recommended.

The critical need for the protection of the public health and the beneficial uses of the Bay waters led, in December 1958, to the acceptance by the City Council, City of San Diego, of the consulting engineers' plan to construct a "metropolitan" sewerage system for the entire San Diego Bay Area. In September 1959 the City authorized the consultants to proceed with the preparation of detailed plans and specifications for the system. A bond issue was successful on November 8, 1960; site preparation was started for the Point Loma treatment plant in January 1961, with construction of the system under way in August of that year. A description of the San Diego Metropolitan Sewerage System will be presented in a following section of this chapter.

(2) Contiguous Communities

As noted previously, the City of San Diego was not the only municipality discharging domestic sewage wastes to San Diego Bay. The neighboring communities of National City and Chula Vista; the cross-Bay City of Coronado; and two cross-Bay Federal installations -- United States Naval Air Station on North Island, and the United States Naval Amphibious Base on Silver Strand, were also contributing domestic sewage wastes, treated and untreated, to the Bay. National City, La Mesa, Lemon Grove and Rolando Sanitation Districts and the North Island Naval Air Station eventually joined the City of San Diego system while that facility was still discharging treated effluent to the surface waters. Table II indicates the 1951 status of domestic wastes discharges to San Diego Bay. When various smaller discharges are considered, some 37 million gallons per day of raw and treated domestic sewage wastes were being discharged to the Bay at that time.

(3) San Diego Metropolitan Sewerage System

With the success of the 1960 bond issue (\$42,500,000) ensuring the completion of the San Diego Metropolitan Sewerage System (6), the City of San Diego began implementation of the ambitious project. The City assumed control of the basic system including design, financing, construction and operations -- acting for, and in the interests of, the cities of Chula Vista, Coronado, El Cajon, Imperial Beach, La Mesa, National City and San Diego, and the Lemon Grove, Montgomery, Rolando and Spring Valley Sanitation Districts. Only Santee and Tijuana, Baja California, Mexico, of the metropolitan service area are excluded -- having sewage treatment systems of their own.

Basically the San Diego Metropolitan Sewerage System collects domestic and industrial wastes from inland and contiguous communities of San Diego Bay. The interceptor system conveys wastes to two pumping stations from which, utilizing a combination of force and gravity mains and a Point Loma tunnel, sewage is delivered to the primary facility on the seaward side of Point Loma. Effluent is discharged to the Pacific Ocean at a depth of from 200 to 220 feet; the outfall extends 11,450 feet from shore and terminates in two diffuser legs, each 1,368 feet in length. The dilution and dispersion pattern of the ocean environment at the point of discharge has made chlorination of the effluent unnecessary at the present. Digested sludge is conveyed by force mains to the Mission Bay area north of Point Loma where it is used as a soil conditioner for reclaimed land. Plate II depicts the major appurtenances of the sewage disposal facility.

TABLE II
DOMESTIC WASTE DISCHARGES
SAN DIEGO BAY
1951*

Source of Discharge	Volume of Discharge (mgd)	Remarks
City of San Diego	32.05**	Basic plant provided preaeration, primary sedimentation, separate sludge digestion with chlorination of the effluent beginning June-July 1956. Volume of discharge had reached 39.0 mgd in 1955 and was estimated at 50.0 mgd in 1960.
City of National City	1.34***	Sewer collection system constructed in 1921 with 12-inch outfall discharging raw sewage to San Diego Bay. National City contracted with City of San Diego in January 1942 to take the entire sewage flow to the San Diego system.
City of Chula Vista (a) Original plant (b) New plant	0.30 0.84	The original sewerage system, completed in 1926, consisted of a gravity sewer collection network and a rectangular Imhoff tank. Effluent was discharged through a 15-inch outfall to San Diego Bay. A separate sludge digestion tank was provided in 1943. An additional treatment plant consisting of preaeration, primary sedimentation, secondary aeration, secondary sedimentation; separate sludge digestion and chlorination of the effluent was constructed in 1949. In 1951 the City contracted for the sale of 0.60 mgd of effluent from the new plant to be used for irrigation.
City of Coronado	1.10	Collection sewers, pumping stations and sewage outfalls installed during period 1890-1920. Two separate outfalls discharged raw sewage to San Diego Bay. Outfall and pumping station construction during 1944-1946. Discharge to the Bay was chlorinated beginning in June-July 1956. Sewage wastes were diverted to the San Diego Metropolitan Sewerage System beginning in February 1964.
North Island Naval Air Station	0.30***	Sewer collection system terminated with raw sewage outfall to San Diego Bay. Submarine sewer constructed and contract concluded in 1942 for conveying sewage to City of San Diego system.
Naval Amphibious Base	0.10(E)	Organized in 1942, the Base dumped raw sewage into San Diego Bay until it joined the San Diego Metropolitan Sewerage System in December 1964. Flow at that time was estimated at 0.20 mgd. Discharge to the Bay was chlorinated beginning in June-July 1956.

* References (2) and (3) with additional remarks by the writer.

** Includes flow from La Mesa, Lemon Grove and Rolando Sanitation Districts, and North Island Naval Air Station.

*** Volume of sewage flow included in total of City of San Diego system for 1951.

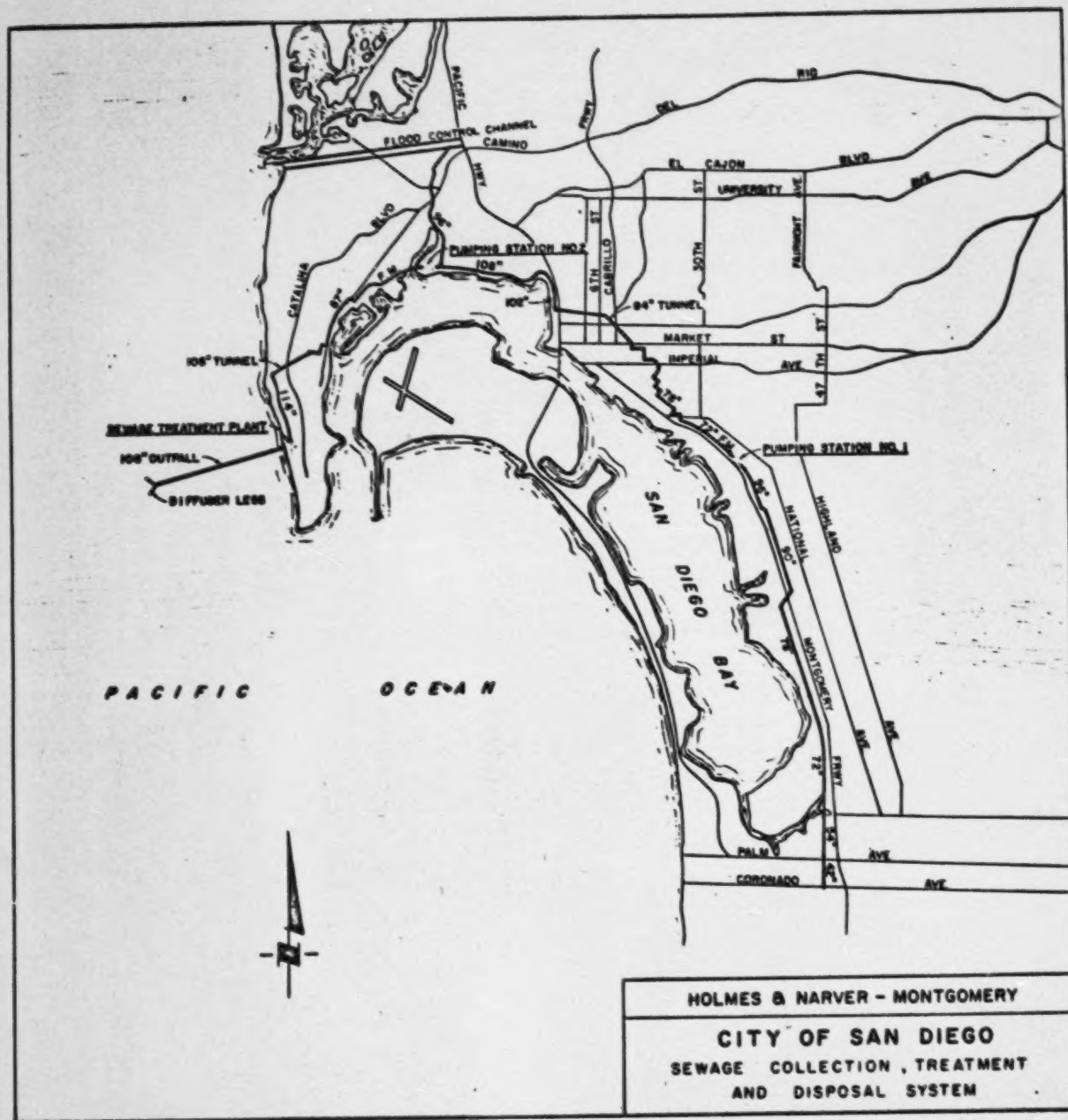


PLATE II

This new sewerage system serves an area of 410 square miles having an anticipated population of 2.6 million persons at ultimate development sometime after the year 2000. Designed for a capacity of 234 mgd, the present average flow is 63 mgd; peak flows have been measured at 95 mgd. Total final cost for the construction of the system was \$51,922,867. Under Public Law 660, the Construction Grants Section, Division of Water Supply and Pollution Control, Public Health Service, made a Federal grant in the amount of \$2,140,120 to the City of San Diego (WPC-CAL-100 (Joint)) to assist the communities with construction of the metropolitan system. In addition, joint-venture cities found it necessary to provide supplemental facilities to implement transfer of wastes to the metropolitan interceptors. Listed below are the communities, project cost, and Federal grants awarded as assistance in the construction program:

City	Grant Designation	Project Cost	Construction Grant
Chula Vista	WPC-CAL-129	138,831	41,640
Coronado	WPC-CAL-128	293,744	72,390
El Cajon	WPC-CAL-80	1,053,658	250,000
Imperial Beach	WPC-CAL-110	264,655	79,390
San Diego	WPC-CAL-126	2,470,527	493,110
Spring Valley Sanitation District	WPC-CAL-116	1,673,706	250,000
Palm City Sanitation District	WPC-CAL-144	43,583	21,790
TOTALS		5,938,704	1,208,320

San Diego Metropolitan Sewerage System began treating wastes in August 1963. The City of Coronado joined the system in February 1964; the Naval Amphibious Base, at a cost of \$330,000, connected in December of that year. With the removal of these two discharges, domestic sewage wastes were excluded from San Diego Bay for the first time in almost 80 years.

Assuming a sewage flow of 60 mgd (in 1963 just prior to the activation of the metropolitan system), having an average 5-day, 20° C, BOD of 170 ppm and a suspended solids concentration of 130 ppm, the Bay was receiving some 85,000 pounds

of BOD and 65,000 pounds of suspended solids per day from domestic wastes. In 1951 San Diego Bay Area communities were dumping approximately 34,460 pounds of BOD and 37,000 pounds of suspended solids per day into these surface waters.

Industrial Wastes

Urbanization of the San Diego Bay Area was accompanied by the establishment of industries -- most of which located their facilities on the shoreline of the Bay. Orientation near the water was directed by four factors:

- (1) the industry used raw materials or resources originating in the marine environment,
- (2) the Bay provided an economical and convenient means of disposing of waste products from the industry,
- (3) the Bay provided an economical and limitless source of condenser cooling water, or
- (4) historical location of industry on tidewater land for plant locations based on less expensive real estate prices and the availability of inexpensive water transportation.

An industry may affect the quality of a receiving water in two ways:

- (1) by discharging to it concentrations of organic or inorganic substances not normally found in the water, or
- (2) using the water and returning it to the source, but with some measurable alteration, i.e., elevated temperature or a greater concentration of dissolved solids.

Specific industries, and their operations, were described briefly in a previous section. The wastes discharged to the Bay, their characteristics, or the way in which Bay waters are altered by the industrial operation are described herein.

(A) Fish Canneries

In fish cannery operation, Bay water is used to thaw fish in the boat fish wells; to flume (transport)

fish from the boat to the shore-side processing plant; and, at times, to provide additional thawing of fish in the thaw tanks of the plant. Thawing and fluming waters contain fish blood, scales, slime and small fish meat particles when these waters are returned to the Bay.

During one step in tuna packing, the filled cans are placed in retorts for final cooking of the product. When the cooking process is completed, the cans are washed and the retort cooled by flushing with fresh water. This waste, containing fish oils and grease and fish meat particles, is discharged to San Diego Bay. All other in-plant wastes flow to the metropolitan system.

In 1951 fish canneries contributed a total of 3,250 pounds of 5-day, 20° C, BOD per day to the Bay. With production in 1964 at about 38 per cent of the 1951 level, BOD contribution is estimated at 1,220 pounds per day.

(B) Kelp Processing

Wastes discharged to San Diego Bay from kelp processing originate in two operations:

- (a) washing with Bay water of chopped kelp for removal of excess salts and plant sugars, and
- (b) digested kelp pulp and filter aid (perlite) from the filtering process.

Wastes from these operations are high in color and suspended solids, and at times exceed 1,500 ppm of 5-day, 20° C, BOD. In 1951 the company producing these wastes was discharging 11,500 pounds per day of BOD and 81,800 pounds per day of suspended solids. In 1964 comparable figures were 20,000 and 40,000 pounds respectively. The decrease in suspended solids was due to an increased efficiency of the filtering process with land disposal of the dewatered pulp. A limited surface area of the Bay continues to be discolored by the discharge. All other in-plant wastes flow to the metropolitan system.

(C) Fish and Animal Reduction

All in-plant wastes, except those from the cooker-drier, flow to the metropolitan system. Bay water

used in the fumes washer is returned to the Bay. In the past, much of the in-plant wastes were also discharged to San Diego Bay. The volume and 5-day, 20° C, BOD values of the wastes from the fumes washer has not varied since 1951 -- the 42 ppm BOD contributing some 270 pounds per day of BOD to the Bay.

(D) Condenser Cooling

Power generation and industrial plants drew approximately 250,000 gpm in a non-consumptive use of Bay water for condenser cooling in 1951. In transit, the water is raised about 15° F in temperature before it is returned to the Bay. Condenser cooling water use, including the large power plants in the South Bay, is currently estimated at 450,000 gpm.

(E) North Island Naval Air Station

During an on-site waste water disposal survey in September 1964, industrial wastes were noted in a direct discharge to San Diego Bay. Although the chemicals present in the discharge were not identified, the wastes originated in shops doing engine cleaning and metal plating, so are presumed to contain concentrations of chromium, phenols, and cyanides, together with a low pH. The flow from each of two existing outfalls was estimated at from 20 to 30 gpm. For an 8-hour shift, this amounts to some 9,600 to 14,400 gpd.

(F) Other Industrial Uses

The salt and chemical production industry and the operation of the oil separation unit by the San Diego Unified Port District, although associated with the water quality and beneficial uses of San Diego Bay, are difficult to depict. Bittern from the salt company is processed for the recovery of magnesium salts -- the remaining concentrated liquor is discharged to the Bay. The use made of the oil separation unit at the Tenth Avenue Marine Terminal is so minimal that discharge from the facility must be considered inconsequential at the present.

A summary of the major industrial wastes being discharged to San Diego Bay for the periods 1951 to 1963 is presented in Table III.

TABLE III

SUMMARY OF INDUSTRIAL
WASTE LOADINGS
SAN DIEGO BAY

1951 and 1963

Source of Discharge	Volume of Discharge mgd		Waste Strength 5-Day, 20° C, BOD Pounds Per Day		Suspended Solids Pounds Per Day	
	1951	1963	1951	1963	1951	1963
Fish Canneries						
(a) Fish wells, fluming and thawing	0.81	1.2	2,400	1,220	5,400	7,114
(b) In-plant operations	0.035	0.028	850	156	350	104
Kelp Processing	0.864	1.5-2.0	11,500	20,000	81,800	40,000
Fish & Animal Reduction	1.7	0.7	1,300	270	32,000	---
Condenser Cooling	360.0	650.0	a	a	a	a
North Island NAS	u	0.0096-0.0144	u	u,b	u	u,b
TOTALS	3.4*	3.7*	16,050	23,446	119,550	47,218

u - unknown

a - elevated temperature only factor involved in water quality

b - probably contains concentrations of chromium, phenols and cyanides, together with a low pH

* - does not include condenser cooling water volume

Wastes From Vessels

Vessels discharging wastes to the waters of San Diego Bay come under various ownerships:

- (1) Commercial
 - (a) U. S. Registry
 - (b) Foreign Registry
- (2) United States Government
 - (a) U. S. Navy
 - (b) U. S. Coast Guard
- (3) Commercial Party Boats
- (4) Pleasure Craft

Records of waste flow from various types of vessels are fragmentary. Where records of fresh water use are available, the waste picture is clouded by the fact most sanitary flushing systems aboard ships use salt water. The salt water flushing system in turn is a non-metered branch of the main salt water pressure system available primarily for fire fighting purposes. There is also a high fluctuation in the number of personnel aboard a specific type vessel while the craft is in port. The complications of accurately estimating the volume and strength of domestic wastes from these vessels are apparent.

Wet garbage produced by vessels in port is not a factor in waste loading. Port District and Navy regulations prohibit the discharge of garbage (by grinding or overboard) to the waters of San Diego Bay. When ships are berthed at piers, a private scavenger service collects garbage wastes; if moored at a buoy, a garbage lighter provides the same service. Disposal of these wastes is provided at a site approved by local health authorities.

Probably the best approach to estimating the waste load being discharged to San Diego Bay from vessels is to use ships' complement figures and assign the standard 0.17 pounds of 5-day, 20° C, BOD per capita per day. Admittedly a rough approximation of the actual waste load, this method of estimating the oxygen demand on Bay water will be used in this section.

(1) Commercial (U. S. and Foreign Registry)

The San Francisco Bay Regional Water Pollution Control Board (7) estimates commercial ships using San Francisco Harbor carry an average of 40 crewmen, and that each ship will remain in port about 43 hours. On this basis, the wastes attributable to commercial vessels using San Diego Bay can be designated as follows:

Year	Ships	Average Number Of Ships Per Day	Crewmen Per Ship	Pounds BOD Per Capita Per Day	Maximum Pounds BOD Per Day
1953-54	130	0.36	40	0.17	2.4
1963-64	644	1.76	40	0.17	12.0

No allowance has been made for crewmen who may have shore leave while in port. This compilation indicates the BOD loading from commercial ships has increased from 2.4 to 12.0 pounds per day in the 10-year period, 1954-1964.

(2) United States Government

(a) U. S. Navy

Table A of a previous section listed data on Navy ships using San Diego Bay. For the purpose of this report, all ships designated as "possibly in port at any one time" in each category will be considered in port for the waste load discharged to the Bay on that day. Since all ships must maintain a minimum of 25 per cent of personnel aboard at all times, this percentage of the total complement will be used as a minimum contributing population. The total complement will be used as the maximum contributing population. Actually these figures will illustrate the possible minimum and maximum daily 5-day, 20° C, BOD loading discharged to the Bay for a maximum number of vessels Navy might have in the harbor at any one time. Obviously there will be many times when Navy would have considerably fewer units moored or berthed in San Diego Bay. The current waste load attributable to Navy vessels is compiled in Table IV.

In reviewing this compilation it must be remembered, the 6,178 pounds of BOD indicated as oxygen demand for Navy's full complement, and the 1,547 pounds of BOD

TABLE IV

WASTE LOADING FROM VESSELS
UNITED STATES NAVY
SAN DIEGO BAY

Type of Ship	Number Possibly In Port On Given Day	Individual Ship Complement	Total Ship Complement	Pounds BOD Per Capita Per Day	Pounds BOD Per Day Full Complement	Pounds BOD Per Day 25% Complement
AR (Large)	1	550	550	0.17	94	23
AR (Small)	1	525	525	0.17	89	22
ATF	10	70	700	0.17	120	30
CL) CLG)	2	1,500	3,000	0.17	510	128
Destroyer Types	16	245*	3,920	0.17	672	168
AD	1.5	1,000	1,500	0.17	255	64
CVA	4	2,628**	10,512	0.17	1,800	450
AV	2	651	1,302	0.17	222	56
Amphibious Craft	25	440*	11,000	0.17	1,875	470
SS	12	80	960	0.17	168	42
SSN	2	100	200	0.17	34	9
AS	2	958	1,916	0.17	326	82
ASR	1	79	79	0.17	13	3
TOTALS	79.5		36,164		6,178	1,547

*Average complement of all types of craft in this category.

**Does not include air or flag groups -- not normally aboard in port.

assigned to 25 per cent of the complement, represent the maximum and minimum estimates of loading for the maximum number of ships Navy might conceivably have in San Diego Bay at any one time. The maximum value probably will exceed the actual BOD figure a large portion of the time -- the minimum BOD value will probably be exceeded most of the time.

As noted in Table A, Submarine Flotilla One restricts to two, the number of nuclear submarines in port at any one time. These units are prohibited by safety regulations from navigating in the harbor past the Flotilla anchorage near Ballast Point.

Nuclear submarines are not refueled at the San Diego Bay anchorage. Consequently, the possibility of radioactive wastes being discharged to the Bay is minimized. California State Department of Public Health monitors Bay waters for evidence of radioactivity; this data is reported to the Division of Radiological Health, Region IX, Public Health Service, on a periodic schedule. To date, radiological concentrations in Bay waters have been well within the limits required by State regulations.

The San Diego Regional Water Pollution Control Board estimated there were 25,000 men afloat on Navy ships in San Diego Bay in 1951 and 1955 -- from which 2,000 pounds per day of both BOD and suspended solids were discharged to the Bay.

(b) U. S. Coast Guard

The Coast Guard maintains three ships at San Diego Bay as reported in a previous section. The "search-and-rescue" mission of this Federal agency promotes a berthing pattern which can never be described as routine -- the units operate as the need dictates.

The best approximation of waste load contributed to the Bay is to consider all crewmen aboard on any day a ship was berthed. The maximum daily waste load would occur when all three units were in port at the same time.

A tabulation of Coast Guard's possible waste load contribution is as follows:

Ship	Number in Port on Given Day	Complement	Pounds BOD Per Capita Per Day	Pounds BOD Per Day Full Complement
Cutter ALERT	1	28	0.17	4.8
Patrol CAPE NEWAGEN	1	14	0.17	2.4
Patrol CAPE JELLISON	1	14	0.17	2.4
TOTALS	3	56		9.6

No allowance has been made for crewmen who may not be aboard when ship is in port. The waste load of approximately 10 pounds of 5-day, 20° C, BOD would represent the maximum daily oxygen demand Coast Guard vessels' wastes could exert on waters of the Bay.

(3) Commercial Party Boats

Commercial party boats are designated as either private party or "open party" charters. Boats usually fall into two size classes, the smaller craft sleeping 20 persons while larger vessels can accommodate about 55.

Party boats leave early in the morning, pick up bait from the live bait barges and head for the fishing area. The boat may remain out for as long as 24 hours; the capacity of the boat sets the upper limit of persons aboard; in 1964 there were 43 boats operating out of the commercial boat basin.

The mode of operation of party boats makes a determination of waste load contributed to San Diego Bay impractical. For this report it is enough to recognize these vessels as contributors -- without further evaluation.

(4) Pleasure Craft

State-wide pleasure craft registration indicates 30 per cent of all registered craft are 20 feet or over in length -- a size of vessel which in all probability has a permanently installed marine toilet. Applying this percentage to San Diego Bay, there are approximately 5,700 pleasure craft with marine toilets using the

Bay as a home port. An additional 15,000 vessels are within easy cruising or trailering range and presumably use the Bay at one time or another. Shelter Island and vicinity has space for 2,000 slips; it is estimated 90 per cent of craft docked in this area equal or exceed the 20-foot dimension. This area alone then would account for some 1,800 vessels equipped with marine heads.

As with party boats, it is impractical to estimate the probable waste load contributed to the Bay by these craft. They should, however, be recognized as waste load contributors.

Other Activities or Contributions

Although not usually designated as waste disposal practices, three additional process or contributory loadings are related to the waters of San Diego Bay. They are:

- (1) filling of tidelands for industrial or commercial development,
- (2) inflow from natural water courses, and
- (3) inflow from storm drains.

San Diego Unified Port District has extensive plans, particularly in the South Bay, for the filling of tidelands for industrial and commercial property development.

Otay and Sweetwater Rivers empty into South Bay; they are subject to tidal influence and flow only when there is a heavy rainfall for an extended period -- a not too usual occurrence in the vicinity of San Diego Bay.

As the San Diego Bay Area has become urbanized, storm drains have carried ever increasing amounts of storm runoff. These fresh-water wastes carry chemical and bacteriological contaminants to the Bay.

Summary of Waste Loads

A summary of waste loads entering San Diego Bay for the periods 1951 and 1963 are presented in Table V. Since a detailed breakdown has been shown under the separate categories within this section, Table V will tabulate these waste loadings under general headings.

TABLE V
SUMMARY OF WASTE LOADINGS
SAN DIEGO BAY

1951 and 1963

Category of Wastes	Origin of Wastes	Waste Loadings (pounds/capita/day)			Remarks
		5-day, 20° C, BOD 1951	1963	Suspended Solids 1951 1963	
Domestic	Municipal and Federal Agency sanitary sewage	34,460	85,000	37,000	65,000 Waste load also contributed floating solids, turbidity and bacterial population.
Industrial	Various industries; a Federal installation	16,050	23,446	119,550	47,218 Fish canneries, kelp processing, fish and animal reduction, con- denser cooling water, and engine cleaning and metal plating. Floating solids, especially oil slicks and grease rafts; color, turbidity and elevation of water temperature.
Vessels	Various ships, boats and craft	2,000	1,569 to 6,200	2,000	1,808 to 7,233* United States Government and com- mercial ships; party boats; pleasure craft. Waste load also contributes floating solids and bacterial population.
TOTALS		52,510	110,015 to 114,646	158,550	114,026 to 119,451

* - Based on 0.20 pounds of suspended solids/capita/day

EFFECTS OF WASTE DISPOSAL PRACTICES

ON WATER QUALITY AND BENEFICIAL

USES -- SAN DIEGO BAY

General

Prior sections of this report have documented the origin of domestic and industrial wastes, and the history of their disposal in the San Diego Bay Area. Data has been presented for 1951 and 1963 for specific reasons:

- (1) although the City of San Diego had completed expansion of its sewage treatment facilities by 1950, the new plant was operating near design capacity when placed in operation -- and increased loadings in the years immediately following 1951 started the unchecked degradation of water quality in San Diego Bay;
- (2) two major works (references (3) and (4)) were published in 1952, which provided a large amount of factual data on the water quality of San Diego Bay and waste disposal practices in the San Diego Bay Area for 1951; and
- (3) data for 1963 accurately reflects the water quality of San Diego Bay and waste water disposal practices in the San Diego Bay Area prior to the activation of the San Diego Metropolitan Sewerage System in August of that year.

It is important to establish the water quality of San Diego Bay in 1951 -- and to follow the trend through the intervening years to 1963, prior to the inauguration of the Metropolitan System. By this process we are able to trace the fate of water quality in a naturally restricted body of marine water, as bordering communities continue to discharge to it raw and treated domestic and industrial wastes. It is equally important to describe the rehabilitation of the Bay brought about by these same communities which not too long ago had seemed intent on destroying their most valuable natural resource.

Water Quality

Water quality can be measured by various parameters -- however, the effect of water quality on beneficial uses is most clearly characterized by the parameters of dissolved oxygen (DO), coliform group density (MPN), water clarity, suspended solids, and floating solids of sewage origin.

These parameters are directly responsive to waste loadings imposed on the body of water. The waste loads and their effect upon dissolved oxygen, coliform group density and water clarity will be discussed specifically.

(1) Waste Loading Effect on Dissolved Oxygen

In a body of marine water like San Diego Bay, oxygen is introduced from three primary sources:

- (a) reaeration from the atmosphere,
- (b) photosynthesis by chlorophyll bearing phytoplankton, and
- (c) tidal exchange.

Adequate dissolved oxygen (DO) in a surface water is necessary for the life of fish and other aquatic organisms. Biological decomposition, and the resultant oxidation of organic material under aerobic conditions, is a counterforce attempting to withdraw oxygen from the same water. This need for oxygen in supporting biological decomposition is referred to as "biochemical oxygen demand" (BOD).

The discharge of wastes, containing organic substances, to a body of water, exerts such a BOD on the aquatic environment. There is an obvious interplay between deoxygenation and reaeration of a given body of water receiving a waste load. Under aerobic conditions, the receiving waters remain clean in appearance and free from odor. Conversely, under anaerobic conditions, waters become unsightly, malodorous and destruction of the normal aquatic plants and organisms occur. These outward signs of septicity invariably result in nuisance complaints. To enable a body of water such as San Diego Bay to exist as a useable resource, the biochemical oxygen demand must not exceed the available dissolved oxygen supply.

The critical depletion of DO reserves in San Diego Bay was first demonstrated in 1951. Miller and Nusbaum (3) determined it was impossible to draw a conclusion as to the capacity of the Bay to receive oxygen demand wastes based merely on the apparent oxygen resources of the Bay and the known volume of waste discharged. Upon further evaluation, however, they did conclude,

"... San Diego Bay has reached the limit for the disposal of oxygen demand wastes into the central and south areas of the Bay. Capacity is available in the north part of the Bay if wastes were to be disposed of well up towards the mouth of the harbor"

As noted in Table V, the combined domestic, industrial and vessel discharges were dumping 52,510 pounds of BOD per day into the Bay. Plate III indicates the degree to which DO levels were depressed during the period 1951-1955. The entire central portion of the Bay had dropped below 4.0 ppm -- according to the California Department of Fish and Game (1952), a level below which a normal fisheries environment in a marine estuary could not be supported. As the results of additional research have become available, aquatic biologists now believe it is essential to maintain a minimum of 5.0 ppm of DO to assure a suitable marine environment for a stable or increasing fishery. Only South Bay and a portion of North Bay were able to demonstrate DO values approaching the desired 5.0 ppm. A limited section at the entrance to the Bay, where tidal exchange was bringing in large quantities of replacement oxygen, exhibited a DO level near 6.0 ppm

Notwithstanding danger signals of a rapidly disappearing DO content of Bay waters, and the admonishments of the Board of Engineers and the San Diego Regional Water Pollution Control Board, voters turned down a sewerage bond issue in 1954. Passage of the bonds would have implemented the recommendations of the Board of Engineers -- removal of wastes from San Diego Bay with disposal through an ocean outfall. Voter opposition centered around the proposed Point Loma location of the sewage treatment plant and the finance plan set forth by its proponents. Consequently, communities continued to discharge wastes to the Bay -- conservatively estimated as increasing by 2.0 million gallons per year from 1951 to 1955. By March of the latter year the Regional Board estimated some 79,000 pounds of BOD were entering the Bay each day from domestic, industrial and vessel sources.

Waste loads continued to mount. By 1963 as much as 115,000 pounds of BOD per day were being discharged to the Bay. The period from 1954 to 1960 became an "emergency era" -- with chlorination of the effluents of the three major domestic discharges (San Diego, Coronado and Naval Amphibious Base) instituted by the San Diego Regional Board in 1956. Although Plate IV is indicative of DO conditions in 1960, the situation was no better in 1963, with many indications it may have deteriorated even more by that time. Levels had dropped below 4.0 ppm in all areas -- with the exception of the entrance to the Bay where oxygen-rich ocean waters were replenishing DO by tidal exchange. Dissolved oxygen levels fluctuated substantially and in the areas marked less than 4.0 ppm, concentrations in the order of 1.0 ppm were not uncommon.

Community awareness of the serious physical condition of San Diego Bay waters, spurred the passage of a sewerage system bond issue in 1960. By August 1963, the San Diego Metropolitan Sewerage System was receiving the first wastes from the area. By December 1964 the last community domestic sewage wastes were excluded from the Bay.

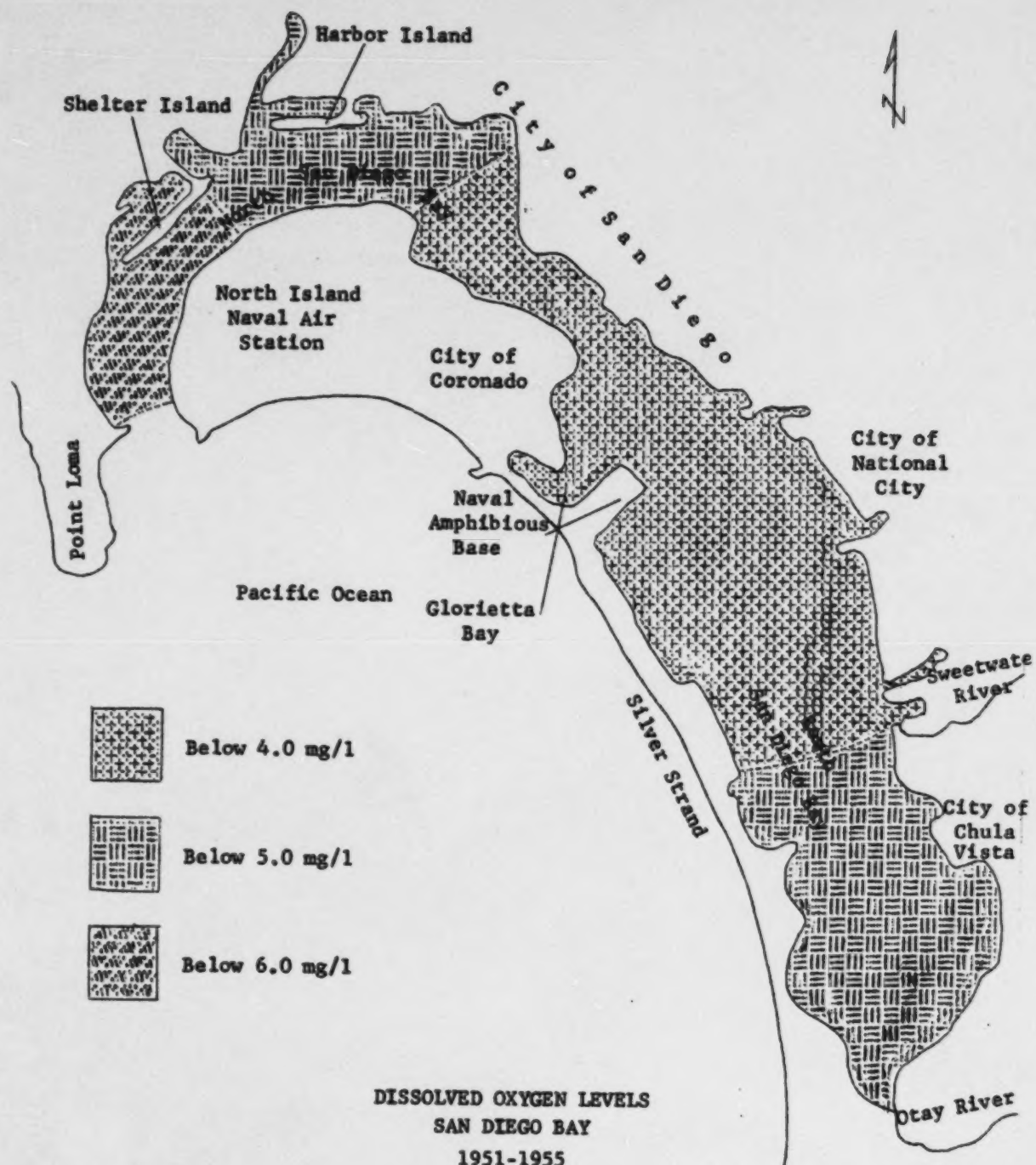


PLATE III

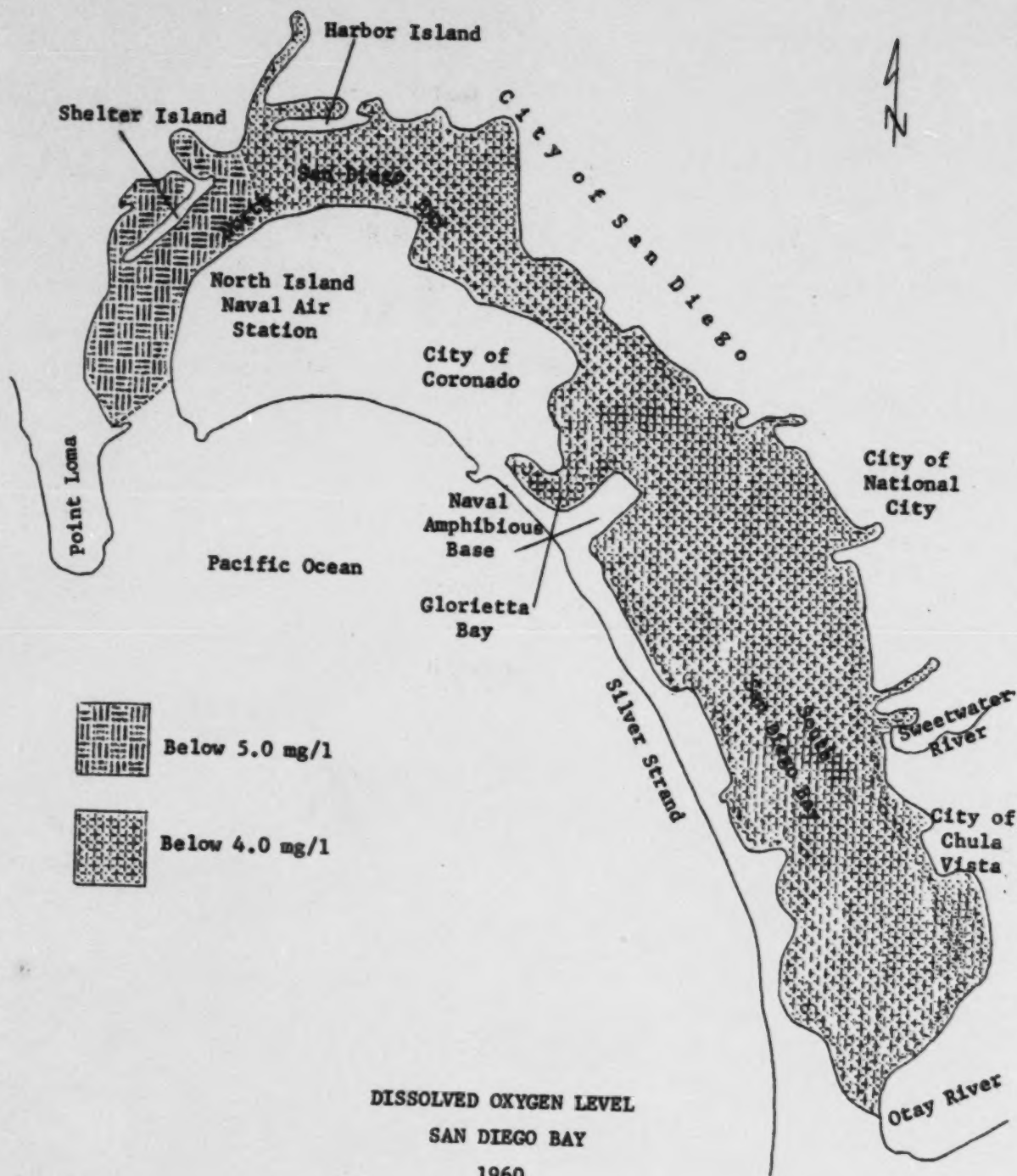


PLATE IV

The recovery of the body of water was dramatic -- in less than a year DO levels exceeded 6.0 ppm in the central and south portions, and ranged above 7.0 ppm in the north and entrance sections of the Bay. The extent of the two oxygen levels is shown on Plate V.

Although removal of community domestic sewage wastes and many industrial discharges was accomplished by the new metropolitan system, industrial wastes and untreated domestic wastes still entered the Bay. Industrial wastes, and their origin, have been described in detail. By 1963 these industries were discharging 23,446 pounds of BOD and 47,218 pounds of suspended solids per day -- a substantial loading. Untreated domestic wastes originated entirely with the "floating population" of commercial, United States Government, party boats and pleasure craft vessels. The largest single group of vessels discharging these wastes was units of the United States Navy. The combined discharge of all vessels ranged from 1,569 to 6,200 pounds of BOD per day and from 1,808 to 7,233 pounds of suspended solids per day.

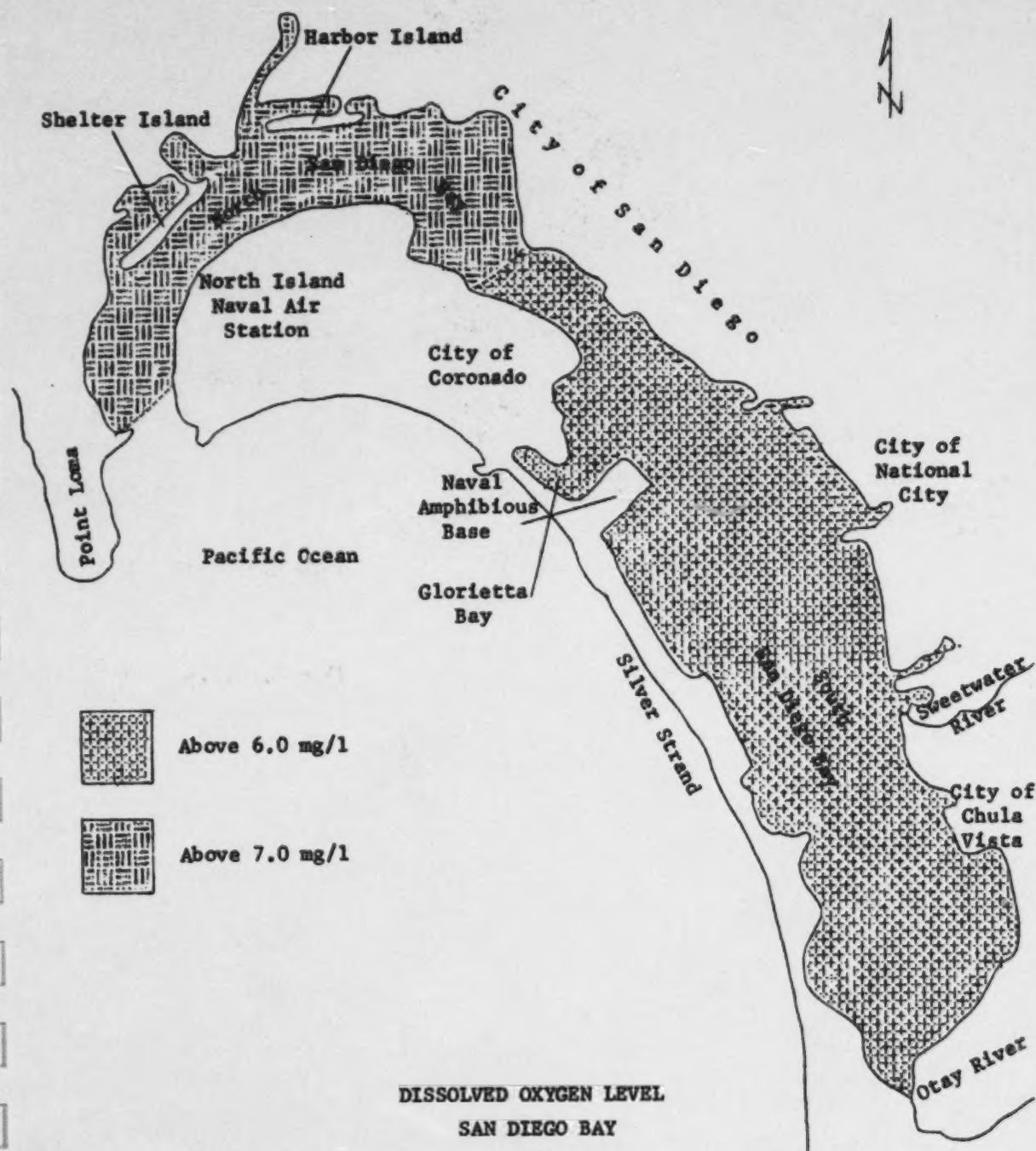
The effects on the DO of San Diego Bay from continuing industrial discharges and those untreated domestic wastes originating on vessels, since 1963, would be difficult to demonstrate. The comparatively large amount of dissolved oxygen now available, in relation to the BOD loading from these sources, would mask the effect -- depression of DO level would be minimal. Their important water polluttional aspects will be discussed in following sections.

(2) Waste Loading Effect on Coliform Group Density (MPN)

Laboratory methods are not readily available to water pollution control authorities for the detection, isolation or enumeration of pathogenic bacteria in water. Instead the coliform group of bacteria has been used to indicate the pollution of water with human and animal wastes and thus the suitability of water for a particular beneficial use.

It has become the custom to report the results of the coliform test by the multiple-tube fermentation procedure, as a "most probable number" (MPN) index. Although it is not an actual enumeration of the coliform bacteria, it is a valuable tool for appraising the sanitary quality of water.

Raw sewage, and even the chlorinated effluent of a sewage treatment plant, contains millions of coliform bacteria. With optimum receiving water conditions, i.e., an adequate food supply, a non-toxic environment, lack of predatory animals and satisfactory



DISSOLVED OXYGEN LEVEL
SAN DIEGO BAY
1964

PLATE V

temperature, these bacteria can exist and reproduce for extensive periods. With constant replenishment from a continuing discharge of sewage wastes, the coliform group density (MPN) tends to increase and spread outwardly from the point of discharge. Eventually, without controls, large areas of the receiving waters will maintain MPN values in excess of those necessary to protect particular beneficial uses.

The sequence of domestic sewage discharges, treated and untreated, to San Diego Bay has already been described. By 1943 the City of San Diego alone was discharging 14 mgd of treated (but not chlorinated) effluent -- in 1951 the tributary area was producing a combined (raw or treated, but not chlorinated) discharge of about 37 mgd.

Coliform densities continued to mount until emergency chlorination was ordered for San Diego, Coronado and the Naval Amphibious Base discharges by the San Diego Regional Water Pollution Control Board in 1956. Admittedly a stop-gap measure, chlorination of these discharges did reduce MPN values in many areas of the Bay. However, population expansion raised the discharge from the City of San Diego to 40 mgd in 1950; by 1960 the tributary area was dumping a total of 60 mgd of treated and untreated effluents (all chlorinated) into the Bay. The effect of these huge discharges was especially noticeable in the area of the outfalls, even with chlorination of the effluent.

Public health authorities have established maximum densities of the coliform group (as indicated by the MPN index) for several beneficial uses of water:

- (a) drinking water, or other domestic uses;
- (b) ocean water-contact sports;
- (c) certain industrial uses; and
- (d) shellfish production areas.

Since San Diego Bay is a salt water resource, drinking water standards will not be discussed.

The California Administrative Code, and California Health and Safety Codes, have established "Laws and Regulations Relating to Ocean Water-Contact Sports Areas". Title 17, California

Administrative Code, Article 4, Healthfulness, Section 7958,
Bacteriological Standards, states,

"... Samples of water from each sampling station at a public beach or public water-contact sports area shall have a most probable number of coliform organisms less than 1,000 per 100 ml (10 per ml); provided that not more than 20 per cent of the samples at any sampling station, in any 30-day period, may exceed 1,000 per 100 ml (10 per ml), and provided further that no single sample when verified by a repeat sample taken within 48 hours shall exceed 10,000 per 100 ml (100 per ml)."

On November 14, 1947 the California State Board of Public Health prescribed standards for the quality of water which may be used in handling fish intended for canning. A digest of these standards follows:

(A) Waters satisfactory without treatment

(a) For whole and cut fish handling

- (1) Not subject to contamination with human fecal discharges
- (2) Maximum of 7 E. Coli organisms per cc

(B) Waters satisfactory after treatment

(a) For whole and cut fish handling

- (1) Not subject to gross contamination with human fecal discharges before treatment
- (2) Maximum of 3 E. Coli organisms per cc after treatment

Part I, Sanitation of Shellfish Growing Areas, Public Health Service Publication No. 33, Revised 1962, indicates,

"... The coliform median MPN of the water does not exceed 70 per 100 ml, and not more than 10 per cent of the samples ordinarily exceed an MPN of 230 per 100 ml for a 5-tube decimal dilution test in those portions of the area most probably exposed to fecal contamination"

Plate VI shows the extent of coliform densities in 1951. Virtually all of the central portion and much of the South Bay exceed an MPN of 1000/100 ml. Two smaller areas, one off North Island and the other near the commercial boat basin, frequently exceeded this value.

With increased sewage flows (1960), the emergency chlorination program produced some areas of reduced coliform densities. However, MPN's exceeding 1000/100 ml were concentrated around the discharge outfalls of San Diego, Coronado and the Naval Amphibious Base. Much of the central portion of the Bay and a small area off Harbor Island maintained values which frequently exceeded 1000/100 ml. These densities are shown on Plate VII.

In both 1951 and 1960 coliform density in those areas, always greater than 1000/100 ml, was, at times, tenfold this value. In unmarked areas on Plates VI and VII, the density occasionally exceeded 1000/100 ml.

In compiling additional coliform density data in 1963, the San Diego Regional Water Pollution Control Board indicates there are some high coliform counts in the Bay which cannot be readily explained. These counts postdate the operation of the metropolitan system. Most of these higher densities have been offshore -- apparently not connected with sewage wastes from shore operations.

The "floating population" of vessels has been the subject of considerable conjecture in the evaluation of the pollutorial source of restricted onshore or harbor waters for some years. Understandably this factor has had more than usual discussion in the San Diego Area where wastes from vessels are now the only major untreated domestic sewage discharges to the Bay. Although suspect in the past, there has been painfully little factual data to substantiate or deny the part these wastes play in the total estuary or harbor pollution picture.

The appearance of unusually high coliform counts and the coincidence of large numbers of vessels of all types using a relatively small body of restricted water, makes it difficult to ignore vessel wastes as a possible answer to the remaining pollution problem. Since Navy operates the bulk of ships in the harbor -- and has, by far, the most personnel aboard, this Federal agency becomes the primary suspect as the source of the remaining coliform density pollution of San Diego Bay.

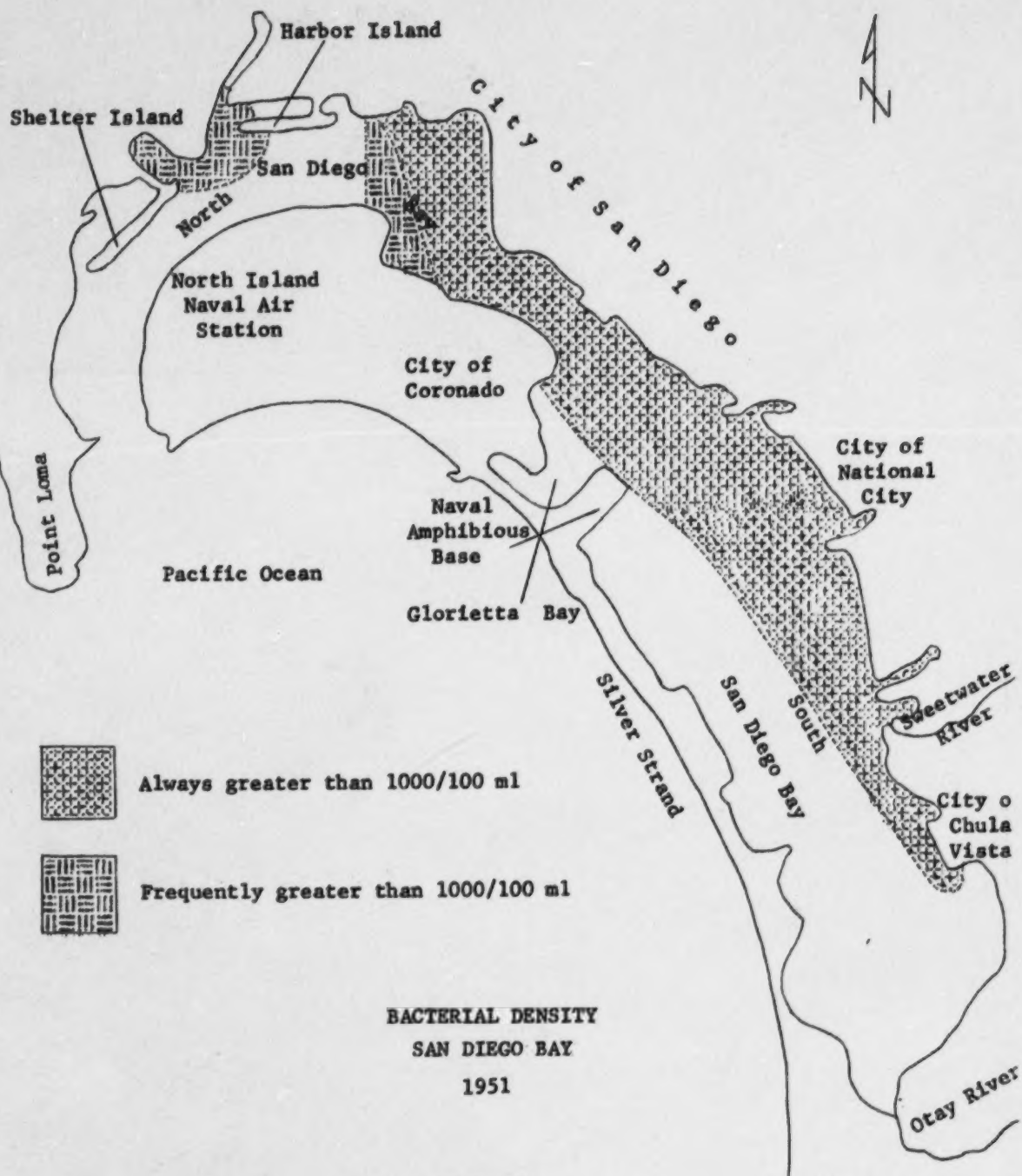
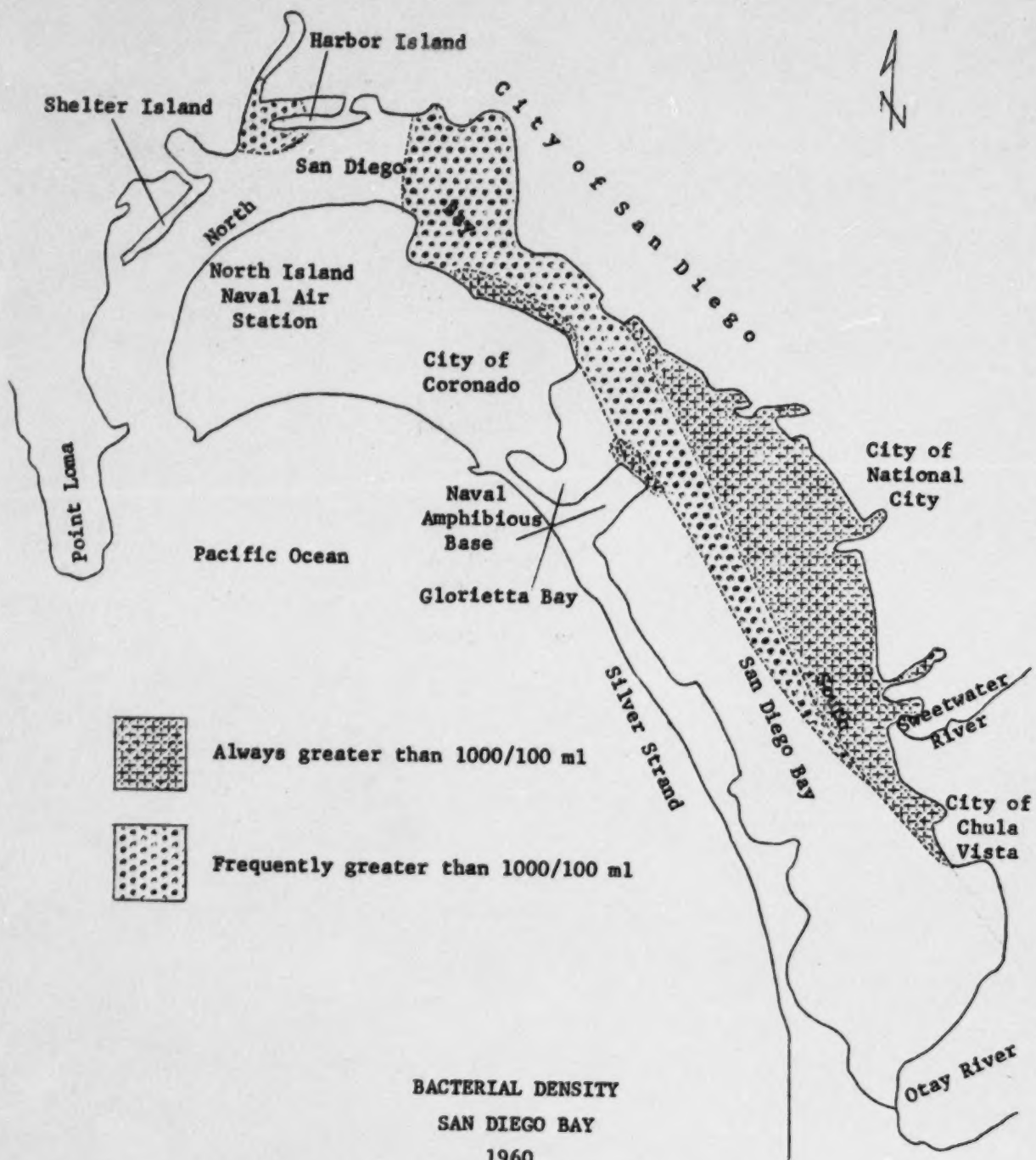


PLATE VI



BACTERIAL DENSITY
SAN DIEGO BAY
1960

(3) Waste Loading Effect on Water Clarity

Water clarity is measured by use of a Secchi disk, a circular metal plate, 20 cm in diameter, the upper surface of which is divided into four equal quadrants and so painted that quadrants opposite each other are black and the intervening ones white. In operation, the disk is lowered vertically and the depth at which it disappears from sight is noted; the disk is then lifted and the depth at which it reappears is recorded. The average of these figures is considered to be the limit of visibility -- or the Secchi disk reading.

In San Diego Bay, water clarity is a direct reflection of the productivity of chlorophyll bearing plankton. In turn, the ability of these plankton to reproduce is governed by the availability of nutrients in the water. Since sewage wastes contain enriching amounts of nitrates and phosphates, the two major nutrients needed by the algae, waters receiving these wastes normally support extensive algal blooms. The more extensive the bloom, the less the value for the limit of visibility -- and generally the larger the volume of sewage the more probable it becomes for heavy growths of algae to appear. Since Secchi disk readings measure this limit of visibility, they are, in effect, a method of measurement of pollution. They should not be used as a measurement of organic waste pollution, of course, in areas where water currents or wave action produce turbidity through a disturbance of bottom material.

Two problems occur where algal blooms are concerned. Where extensive blooms occur, natural attrition and the rapid disappearance of an adequate food supply, causes a die-off of the organisms in astronomical numbers. This in turn places a large and rapidly exerted BOD on the DO content of the water -- often causing complete depletion of the dissolved oxygen.

The second factor is known as the diurnal cycle in the life of the algae. During daylight hours algae are able to utilize sunlight and carbon dioxide for their metabolism. When darkness appears, however, the organisms are unable to synthesize the carbon dioxide efficiently and turn to the dissolved oxygen for sustenance. This action also depresses the DO content of the water -- again, if the bloom is extensive, the dissolved oxygen content may be completely depleted.

The ability of light to penetrate depths of water, greatly affects photosynthesis -- and thereby the amount of reaeration due to this process. When wastes are discharged to a body of water, light penetration may be diminished by turbidity or color -- and photosynthesis decreased or even eliminated. If the waste load is great enough, septic conditions may occur which

would also interfere with the growth of algae -- and, in turn, the reeration process. The inter-relationship of waste loadings, plankton metabolism, organism die-off, DO depletion and decreased photosynthesis, are complex and important factors in the maintenance of water quality in a body of water receiving waste loads.

In demonstrating comparative water clarity due to waste loads, Secchi disk readings were recorded in areas of the Bay most likely to be affected by the discharges. This was roughly from the Broadway Pier southward to a point opposite the Naval Repair Base -- the shoreline of which accommodated all of the major industrial discharges, and the outfall of the City of San Diego sewage treatment plant. Since the Bay narrows in this area, the readings also reflected, to some extent, the sewage discharges from Coronado and the Naval Amphibious Base.

In 1951 disk readings ranged from one of eight feet, and in general averaged about six feet. In 1963, after the removal of the major sewage discharges, Secchi readings ranged from ten to thirty feet -- with the lower values being found in the southerly part of the Bay where bottom sediments restricted visibility. Water clarity, in fact, improved by at least a factor of three in this critical section of the Bay. This improvement in water clarity has, along with the reappearance of game fish species, been an indication to the public at large of the improvement of water quality in the Bay.

(4) Waste Loading Effect of Suspended Solids and Floating Solids of Sewage Origin

Although the suspended solids content of wastes discharged to the Bay was a factor in water clarity (as described in the last section), they were an even more important pollutional aspect in the immediate vicinity of domestic and industrial waste outfalls. While that portion of suspended solids which did not readily settle out (colloidal or very finely divided particles) was affecting water clarity, heavier solids were being deposited on the floor of the Bay.

Beginning with the first raw sewage discharges in 1937, and continuing with treated domestic sewage effluents (and at times large volumes of digested sludge) until August 1963, the Bay floor was laden with varying amounts of inorganic and organic solids. The fish cannery, kelp processing, and animal and fish reduction industries contributed immense loadings to the area directly offshore from their plants. By 1951 a band 200 yards wide and 9,000 yards in length (from the U. S. Coast Guard Station to the south end of the Naval Supply Base), was covered with sediments of waste origin. These deposits reached depths of three feet at a pier-line distance

from the shore. Additional sludge beds were detected along the water fronts of Chula Vista and National City.

By 1963 bottom sediments directly related to the waste loadings described above had increased in depth to 7 feet. Benthic marine organisms were missing from the total area covered by the sludge beds. Decomposing organic material depleted the dissolved oxygen content of overlying water and septic conditions produced noticeable quantities of hydrogen sulfide. Onshore waters in the critical areas depicted a marine environment subject to heavy pollution.

Bottom sediment monitoring, since the advent of the metropolitan system, has continued to chart the depth and areal extent of these sludge beds. Generally, there has been a decrease in both depth and area covered. Sediments of waste origin have been consolidated by approximately one half (averaging about 3 feet in depth). Although the area of the beds appears to have decreased, the extent to which this has been affected through dispersion by current action is not known. Continuing decomposition of the sludge beds has not noticeably affected the DO of water in the vicinity of the deposits.

Floating solids of sewage origin consist mainly of feces and grease particles. These materials collect in "rafts" on the water surface or are washed up on the shoreline of the Bay -- producing both public health and aesthetic problems for the communities. The presence of these solids are detected by visual observation.

Effects of Water Quality on Beneficial Uses -- San Diego Bay

Preceding material has traced the reaction of water quality parameters such as DO, coliform bacteria density (MPN) and water clarity, to persistent waste load discharges to San Diego Bay. Sufficient data has been compiled to assess the cumulative effects of degradation of water quality on the stated beneficial uses of the waters of the Bay.

In order to express the relationship between water quality and beneficial uses, each beneficial use previously reviewed will be listed and the restrictive effects of a degraded water quality upon the use explained. Conversely, the return to water quality has reactivated dormant beneficial uses -- and this process will be presented.

(1) Maritime

Although this use may be the least affected by a degraded quality of marine water, some aspects should be mentioned.

- (A) U. S. Navy and U. S. Coast Guard ships are prohibited from using harbor and port saline waters in showers, laundries and for flushing decks. They are also enjoined from operating their potable water distillation units while in these restricted waters. Prohibition of these uses has been enforced on U. S. Government vessels due to the widespread bacterial pollution of harbor waters.

Section 72.103(c), Interstate Quarantine Regulations, Public Health Service, advises vessels engaged in interstate commerce,

"Overboard water treated on vessels shall be from areas relatively free of contamination and pollution."

While the relaxation of Navy and Coast Guard regulations is not foreseen and many commercial vessels do not use harbor waters, a human error and subsequent use of Bay water, would be somewhat less likely to cause enteric disturbances since domestic wastes, and thereby bacterial pollution, has been removed from the Bay.

- (B) Unconfirmed reports in the early 1950's indicated there was some damage to lead-based paints and bronze ship fittings on Navy vessels from the hydrogen sulfide content of Bay water. Stabilization of the extensive sludge beds has removed this source of corrosive sulfides from the Bay.
- (C) Additionally unconfirmed data was that corrosion had been accelerated on Navy ships of the Pacific Reserve Fleet due to extensive blooms of phytoplankton. The increase in water clarity since 1963 indicates considerably less algae concentration near the Fleet anchorage.
- (D) A "negative" benefit has accrued from the increase in marine water quality. Marine borers, virtually swept from the Bay by the pollutional load, have returned. Control measures are now necessary to curtail damage to piling and other wooden pier structures.

(2) Industrial

Fish canneries and power generation plants are specific industries which are directly affected by changes in the water quality of the Bay. Of these two, canneries have the largest stake in the need for a quality marine water.

The thawing and fluming operations of the canneries, as well as the bacteriological standards of Bay water used in these processes, have been described. In using untreated Bay water for whole and cut fish handling, the coliform index of the water must not exceed 7 per cc. The MPN must not exceed 3 per cc where treated water is used.

In 1951 waters of the Central Bay exhibited MPN counts well above 1000/100 ml a large portion of the time. With this degraded water quality a cannery is forced to provide treatment (at least chlorination) to obtain a quality of water suitable for processing of the fish. This is an added expense to an industry already plagued by intense competition. Even with chlorination, a liberal interpretation of "gross contamination" might have eliminated the use of Bay water for canneries.

Power plant condenser cooling water intakes and pipelines are susceptible to debris clogging and mollusk and slime growths respectively. Prior to exclusion of domestic wastes from the Bay, bait fish kills would cause a massive blockage of the intake grating -- and disrupt delivery of the cooling water to the plant. Although records do not document the exact cause of the fish kills, it was suspected a depletion of DO or the dumping of a toxic industrial waste may have been responsible.

Slime and mollusk growths appear to thrive in enriched water. When condenser cooling water is withdrawn from the vicinity of heavy waste loadings, these aquatic growths can cause costly maintenance procedures. Conversely, a relatively "clean" marine water generally does not support such luxurious growths of the fouling organisms.

The rapid recovery of the Bay, in late 1963 and early 1964, with commensurate increases in dissolved oxygen, the removal of toxic industrial discharges, and the reduction of aquatic organism nutrients, brought an end to acute repetitions of these two equipment foulings.

New industry, the lifeblood of a growing and expanding economy, is not drawn to geographical areas in which surface waters are grossly polluted. The San Diego Unified Port District and the

San Diego Chamber of Commerce are extolling the "new" San Diego Bay as a natural resource haven for industries seeking locations for their plants. Planning and provision of reclaimed tidelands for plant sites, and additional deep-water marine terminals for economical transportation, are proof of their dedication to the industrial expansion of the area. San Diego Bay, with its enhanced water quality, is the focal point for this expansion.

(3) Aquatic Recreation

Aquatic recreation is, without doubt, one of the classifications of activity most susceptible to marine water quality. Without a suitable quality of water many individual activities are terminated. Since water-oriented recreation is so popular in the West, the aquatic enthusiast often goes elsewhere to enjoy his sport.

Marine water degradation, with resultant restrictions of aquatic recreation activities, is usually associated with high coliform densities and floating solids of sewage origin. While a low DO (possibly an odorous condition), decreased water clarity, and suspended solids might offend some individuals, others might well pursue their recreation in such a marine environment. If the presence of high bacterial counts and sewage solids are publicized by public health officials, however, a very small percentage of the public will hazard bodily contact with the contaminated water. Aquatic recreation activities affected by marine water quality are:

- (a) swimming, bathing and wading;
- (b) beach and tide pool exploration;
- (c) waterskiing and similar boat-towed activities; and
- (d) boating.

Items (a) through (c) above, involve intimate contact of a person's body with the water in which he is enjoying the sport. The regulations by which the State of California protects the public from possible illness while enjoying water contact sports have already been described. Plates VI and VII indicate the extensive areas in which coliform densities (an MPN greater than 1000/100 ml) would preclude these activities.

Bay water quality, as identified by the coliform index, had deteriorated to such an extent by 1955, the California State Board of Public Health felt compelled to act. In December of

that year they ordered a quarantine of all beaches in the vicinity of the City of Coronado, and a posting of warnings along the National City and San Diego shorelines.

With the inception of emergency chlorination procedures in June-July 1956, bacteriological results improved enough to warrant the removal of warnings from a 3 1/2 mile stretch of shoreline on the City of San Diego side of North Bay. Those from Sampson Street (San Diego) to National City remained, until the City of San Diego terminated operation of its municipal sewage treatment plant in August 1963. The beach quarantine for Coronado was removed by official action of the State Board of Health about July 1964 -- after that city had connected to the metropolitan system in February of that year.

The U. S. Navy and Coast Guard are also concerned with the quality of water in the Bay and its relationship to the health of Service personnel. Underwater demolition teams, repair and salvage training, search-and-rescue operations and several other "duty activities" make it necessary for these personnel to be in contact with the water for extended periods. A water quality which would not allow water contact without jeopardizing an individual's personal health, is tantamount to prohibiting the activity. If this occurs, Navy especially, would have to seek other marine areas in which to conduct these training exercises.

Since the removal of municipal domestic wastes from the Bay, there has been a tremendous upswing in public demand for adequate water contact sport facilities. The San Diego Unified Port District is planning to provide several more marinas, and a portion of the newly constructed Harbor Island shoreline will be developed for family swimming and wading activities.

Silver Strand State Park expects to expand its family picnicking, swimming and general recreational facilities to accommodate anticipated increases in attendance. A large portion of the expansion and improvements will be in the area fronting on the shallow waters of South Bay. Navy is also considering a new recreational beach on the Naval Training Center property in conjunction with the Admiral Kidd Club.

In any consideration of a beneficial use and the effect of coliform density, the reoccurrence of unexplained high coliform counts in portions of the Bay must be evaluated. Although there has been much conjecture as to the part vessel wastes play in such pollution, a thorough and scientifically conducted engineering investigation and study, under adequately controlled conditions, has never been made. It is a fact, however, that major ships of

the U. S. Navy (the predominant maritime factor in San Diego Bay) do anchor in the vicinity of areas where such coliform counts have been demonstrated. Since domestic wastes from ships' complements are discharged to the Bay, without treatment, the association of high coliform densities and these waste discharges is natural. Actually, Navy units, by their very presence at or near recreational areas, have been suspect when floating solids of obvious sewage origin have appeared.

There is only one official complaint on record accusing Navy of contributing to the pollution of the Bay. In June 1963, a property owner of Bayview Estates, Coronado, California, complained of domestic wastes and sewage solids, presumably originating from Naval ships berthed at the North Island quay and other units moored at mid-Bay to buoys, being swept onto the beaches of Coronado. In responding to this citizen's complaint, the Executive Officer, California State Water Pollution Control Board, indicated the U. S. Navy and the U. S. Public Health Service had been asked to give the matter their prompt attention. The Public Health Service was also asked to conduct a detailed field investigation as soon as the Bay was free of municipal wastes, so that remedial measures of long-range adequacy could be planned and carried out. Subsequent procedures by the agencies involved in water pollution control in the San Diego Bay Area have been detailed in the Introduction.

The remaining water contact sport, boating, is affected by two general water quality parameters -- coliform density and the aesthetic condition as visually identified through water clarity and floating solids of all types. Fast moving craft often spray Bay water over occupants -- and the presence of sewage solids and other debris makes pleasure boating unattractive.

U. S. Navy personnel are intimately associated with water contact through the use of small craft. For example, thousands of men are transported daily, between shore and ships, in open boats and thereby exposed to the spray of high coliform count water. Open boats are also used to carry fresh provisions to ships at anchor. Fresh water is provided at berths or by barge -- the likelihood of contamination to the water supply exists either through accidental cross-connection or by exposure. If vessel wastes do pollute surrounding marine waters, possibly a danger to health of personnel will still exist even with the removal of municipal domestic wastes from the Bay.

(4) Fish and Wild Life

Fish and wild life endeavors rank in importance with aquatic recreation as activities with a high degree of susceptibility

to marine water quality. The common factor affecting all activities under this heading is, of course, the availability of fish and wild life in the area under consideration. If water quality is so degraded as to make the Bay an unsuitable habitat, fish and wild life will move on to another more hospitable marine environment. Conversely, if water quality conditions are optimum, the Bay will have an abundant supply of game, both fish and fowl. Those activities affected are:

- (a) operations and berthing of commercial fishing and party boats;
- (b) fishing, clamming and hunting; and
- (c) fish and wild life propagation and preservation.

Fish and other aquatic life of a marine environment react very quickly to abrupt changes in water quality. This is particularly noticeable where dissolved oxygen and toxic substance concentrations are involved. Of these two water quality parameters, DO has probably been the dominant factor in affecting fish and other aquatic life in the Bay.

As noted previously, aquatic biologists now believe it is essential to maintain a minimum of 5.0 ppm of DO to assure a suitable marine environment for a stable or increasing fishery. This DO concentration not only assures a fish will live, but may also improve its resistance to disease, ability to reproduce, and possibly its ability to escape natural predators. The presence of toxic substances, in excess of certain concentrations, would have similar long-range detrimental effects on aquatic life in the Bay.

The cumulative effect of domestic and industrial organic waste on the DO of San Diego Bay water has been described. By 1963 levels had dropped below 4.0 ppm in all sections except a small area at the entrance to the Bay -- and it was not uncommon to record concentrations in the order of 1.0 ppm. Fish life reacted predictively -- where spotfin and china croakers, corvina, sand bass, halibut and white sea bass had been abundant, a fishery desert gradually emerged. Sardine, anchovies and myriads of other bait fish followed the larger sport fish. Only a few of the more sturdy rough fish remained in the whole Bay.

Although San Diego Bay has not been considered a major shellfish area, clams, mussels, crawfish, scallops and cockle clams were

found and taken by sportsmen in the South Bay. As waste loads mounted, deposition of sediments, low DO levels and high coliform densities either produced an unhospitable environment or contaminated the shellfish so they were unacceptable for human consumption. By 1963 most shellfish had disappeared from the Bay.

Fish and wild life propagation and preservation at San Diego Bay are closely associated with the shallow, shoreline marine waters. Migratory as well as non-migratory fowl, commercial, sport and fish forage species, and aquatic organisms making up the food chain for larger forms of fishes, all suffer when toxic wastes are discharged or when shallow waters or marshes are turned into reclaimed land. Continued industrial expansion of tideland areas of the South Bay may well restrict the rearing, feeding and preservation grounds for fish and wild life.

The return of condenser cooling water (150° F elevation in temperature) may affect aquatic life in the near vicinity of the discharge. Apparently the effects of thermal discharges on the marine life of San Diego Bay have not been investigated.

As early as April 1964, postdating the advent of the metropolitan system by only 8 months, sculpin, sole, sand bass, octopus, shark, seal, porpoise, steelhead trout, silver salmon, bonefish, black sea bass, barracuda, bonito and yellowtail were swarming back into the Bay. Bonito have been attracted particularly to the power plant warm water discharge near Palm City. Cormorants, bluebills, scoters and mergansers and other species of wild fowl are no longer strangers to public sportsmen.

The clean-up of San Diego Bay has had a twofold effect:

- (a) fishes and fowl have returned in large numbers to a marine habitat of their liking, and
- (b) the return of this fish and wild life resource has sparked a boom in wild life-oriented recreation.

(5) Aesthetic Enjoyment

Sewage solids exposed on beaches by low tides; domestic sewage sludge beds despoiling large areas through septic and malodorous characteristics; decaying algae masses on recreational shorelines; and debris-laden backwaters, are not conducive to aesthetic enjoyment of a water resource such as San Diego Bay. But these are the conditions the public was asked to accept in the Bay, prior to the removal of domestic sewage discharges in August 1963.

Even with this discouraging marine environment, pleasure craft use on San Diego Bay mushroomed along with the explosive use of other aquatic recreational areas in Southern California. Aesthetic degradation of the waters and shoreline of the Bay was unable to hinder the public drive for more and more water-oriented pleasure.

What appeared as a rush for aquatic recreation even in areas of gross pollution, turned into a flood of demands for facilities and opportunities to use the water once the pollutional load was removed. The plans for new swimming areas and marinas have already been described. Private clubs and attractive hotels and motels have been constructed on Shelter Island where full use can be made of modern small boat harbors. Harbor Island is scheduled to have similar facilities in the near future.

The San Diego Unified Port District is planning a "Fisherman's Wharf" at the Broadway Pier, where visitors may relax, partake of seafood delicacies and enjoy the new-found beauty of the Bay. The City of Coronado is planning approval of tower apartments for the Bay front -- and have entertained proposals for an aquatic-type subdivision on the "Rancho Cabrillo" property.

Bay excursions have regained their former popularity and expect healthy increases in patronage in the next few years. Once again, private boats are to be seen cruising leisurely throughout the Bay -- with no further purpose than to be more closely associated with the marine environment.

CURRENT WATER POLLUTION CONTROL ACTIVITIES AND THE NEED
FOR FURTHER DEFINITIVE INVESTIGATIONS -- SAN DIEGO BAY AREA

General

A practical and well-administered water pollution control program, coupled with community action for implementation, rescued San Diego Bay from obliteration as a natural resource. The results of gross pollution, so widely evident in mid-1963, have virtually disappeared from the Bay. This lesson in survival of a unique community resource has been well learned. The magnitude and success of the program could have easily led responsible authorities to rest on their laurels. San Diego Bay communities do not see it this way. Along with continuing day-to-day water pollution control activities, a program of review and evaluation of beneficial use protection policy and water quality objectives is being formulated. Responsible officials feel the water quality of San Diego Bay is now such that they can legitimately inquire into the waste disposal practices still in force -- and objectively evaluate the effect of these practices on beneficial uses and water quality.

There is a genuine sense that the progress made in water quality of the Bay has been substantial -- but that existing water quality objectives may not be high enough to protect the many beneficial uses. Water quality, as indicated by the parameters already discussed, now exceeds some of the requirements established by Resolution 55-1. Officials feel these criteria, adopted 10 years ago, may now need an upward revision. In view of the recently adopted master plan, for the development of tidelands and aquatic recreation oriented facilities in San Diego Bay by the San Diego Unified Port District, updating of the long-range policy on beneficial use protection and water quality objectives may well be mandatory.

It is now evident San Diego Bay communities have embraced one of the major official recommendations to come out of the National Conference on Water Pollution, held in 1960,

"The establishment of a national water pollution control policy whose goal would be to keep waters as clean as possible, in contradiction to a negative policy of attempting to use the full capacity of such waters for waste assimilation."

Current Water Pollution Control Activities

A cooperative water pollution control effort by local, State and Federal agencies, is implementing this policy concept. Waste disposal

practices affected by currently scheduled abatement programs are:

(1) Domestic Wastes

Wastes from vessels are now the only major untreated domestic sewage discharges to San Diego Bay. Apprehension concerning the effects of these discharges on the water quality of the Bay, led the Secretary, Department of Health, Education and Welfare, to appeal to the Secretaries of Commerce, Treasury and Navy, for their cooperation in controlling these wastes. The cooperation of the agencies is expressed in the exchange of correspondence presented in the Appendix.

On December 8, 1960, prior to the proposed discharge of treated wastes from the Point Loma plant, the San Diego Regional Water Pollution Control Board adopted Resolution 60-R30, "A RESOLUTION PRESCRIBING REQUIREMENTS FOR THE DISPOSAL OF WASTES BY THE CITY OF SAN DIEGO INTO THE PACIFIC OCEAN OFF POINT LOMA," for the protection of beneficial uses of the coastal waters of the Pacific Ocean.

(2) Industrial Wastes

With the removal of domestic wastes from the Bay, local water pollution control authorities were in a better position to assess the effect on water quality by continuing industrial discharges. In addition to Resolutions already adopted (Resolution 61-R21, The American Processing Company, August 2, 1961; Resolution 58-R12, Tenth Avenue Marine Terminal, City of San Diego, May 27, 1958), the San Diego Regional Water Pollution Control Board has notified two industries (Kelco, Inc.; Westgate-California, Corp.) of a review of Tentative Resolutions concerning their waste discharges to the Bay. The Board suggested these industries use the requirements set forth in the Tentative Resolutions as guidelines for the planning of improvements in their waste disposal practices.

Resolution No. 138200, City of San Diego, sets forth the guidelines by which individual industrial discharges will be admitted to the Metropolitan Sewerage System. Many industrial wastes, formerly discharged to the Bay, are now accepted for disposal through the Point Loma plant.

During an on-site waste water disposal survey in September 1964 (by the Division of Water Supply and Pollution Control, Region IX, Public Health Service), industrial wastes were noted in a direct

discharge to San Diego Bay from the North Island Naval Air Station. A two-part recommendation to Navy resulted:

- (a) Conduct a complete survey of the source, amount, kind and concentration of chemicals discharged in the industrial wastes from the Buildings #36 and #94 complex.
- (b) Determine if the City of San Diego will allow these specific chemical concentrations to be discharged to their collection system. If acceptable, expedite the discharge of these wastes to the municipal system. If not, determine the degree of dilution or neutralization necessary and prescribe required treatment prior to discharge of the wastes to the San Diego facilities.

Navy is considering these recommendations at the present.

(3) Oil Pollution and Other Waste Discharges to Harbors

The importance of abating oil pollution has been recognized for many years, with United States legislative action for enforcement dating to 1899. Applicable laws, enforced by the Secretaries of the Army (Corps of Engineers) and the Treasury (Coast Guard) are as follows:

- (a) River and Harbor Act of 1899,
- (b) Oil Pollution Act of 1924,
- (c) Oil Pollution Act of 1961, and
- (d) under consideration but not adopted as yet, control of pollution (including sewage) from vessels and certain other sources in the Great Lakes and other navigable waters of the United States.

State of California laws and regulations prohibit the discharge of certain pollutants to watercourses, with detection and enforcement under the direction of the Department of Fish and Game. Supplement No. 1 to the Port of San Diego, California, Tariff No. 1-C, regulates and prohibits the discharge of petroleum products, inflammables, garbage and rubbish to waters of San Diego Bay specifically.

Need for Further Definitive Investigations

Notwithstanding the admirable job already accomplished by local communities in removing waste discharges from San Diego Bay, there is still a need for:

- (1) a study to determine the effects of vessel waste discharges on water quality of the Bay, and
- (2) a comprehensive study of the ecology of the Bay.

The ecological investigation would provide valuable marine environment guidelines by which the overall effects of beneficial use policy and water quality objectives could be gauged.

A constantly growing national demand is being made on water pollution control authorities for reliable data concerning the effects of vessel wastes on bays and estuaries, harbors, ports and other physically restricted marine waters. There is, however, painfully little information available. Since this is of grave concern for areas in which major maritime ports are located, there exists a current need for a resolution of the problem.

San Diego Bay, for a variety of reasons, would present an ideal "laboratory" in which to explore the many facets of the disposal of vessel wastes:

- (1) all land-based domestic wastes have been removed from the Bay,
- (2) the Bay has only a single entrance from the Pacific Ocean,
- (3) there are no surface fresh water discharges from rivers or streams except during periods of heavy precipitation,
- (4) precipitation and runoff are low since San Diego is a semi-arid area,
- (5) San Diego Bay has a large ship-borne population with ships ranging in size from super aircraft carriers to small pleasure craft,
- (6) commercial merchant marine and U. S. Government anchorages are sufficiently separated to permit independent evaluation,
- (7) San Diego Bay has tremendous industrial and recreational potentials to be protected, and

- (8) the United States Navy, United States Coast Guard, the United States Maritime Commission, and local, State and Federal water pollution control agencies have all made explicit offers of cooperation and support of such an investigation.

Navy, Coast Guard, Maritime Commission and private shipping lines, are all studying various methods of disposal of vessel wastes. The Division of Environmental Engineering and Food Protection, Region V, Public Health Service, has been working on a model "harbor sanitation" law for some time. The Committee on Sewage and Waste Disposal From Vessels has been meeting to resolve these perplexing problems since 1960. In addition, many State and local governments have tried to come up with reasonable answers for the disposal of wastes to both marine and fresh waters. With all this activity there has still been no real breakthrough which can be translated into pollution control action.

A major factor in selecting San Diego Bay as the site for an investigation, is Navy's willingness to join in and support such a study. Admiral L. C. Coke, Director, Southwest Division, Bureau of Yards and Docks, informed the Division of Water Supply and Pollution Control, Region IX, Public Health Service, on January 13, 1965,

"... Responding to your solicitation for views regarding a cooperative investigation into the effect untreated shipboard wastes have on water use and quality of confined marine waters, it is felt that a conclusive effort should be made in this area of increasing concern. A thorough and scientifically conducted engineering investigation and study of all aspects of harbor contamination caused by shipping would, at once, confirm or deny the existence of a long alleged problem, define the magnitude of it, and provide direction and scope to planning corrective action. It is proposed that such a study, because of its nature, scope, and probable nation-wide consequence, should properly be promoted and administered by the Public Health Service acting in its constituted capacity as Federal Water Pollution Control Research Agency. SOWESTDIVDOCKS would support a research project of this nature and would certainly welcome the opportunity to participate in any phase of it that might be undertaken within the Eleventh Naval District."

Since Navy commands by far the largest number of vessels (with the most crewmen) in San Diego Bay, their cooperation is essential.

The selection of San Diego Bay as a laboratory for the investigation of pollution from untreated vessel wastes, should not be identified as a purely "local" study. The need for reliable data is national, actually

international, in scope. San Diego Bay, by virtue of its communities' forthright attack on water pollution, and the above enumerated factors, happens to be the best available marine water in which to undertake this investigation.

Recognizing the necessity of factual ecological data on the Bay, the San Diego Regional Water Pollution Control Board requested funds for this type of study from the California Water Quality Control Board for both fiscal 1966 and 1967. Insufficient funds and an assigned low priority prevented authorization in either budget.

Administration of beneficial use policy and water quality objectives is enhanced by an accurate knowledge of the ecological background of the receiving waters. As ecological changes occur, needed revisions and updating of policy and objectives can be interpreted to the general public -- for a water pollution control program consistent with their over-all best interests. It is especially important for complete ecological knowledge to be available in support of the proposed vessel wastes investigation.

RECOMMENDATIONS

- (1) The United States Public Health Service should sponsor a study of all aspects of water pollution caused by the discharge of untreated wastes from vessels. Since the volume of these wastes is greatest at vessel concentrations such as harbors, ports, bays and estuaries, it is desirable to conduct the study in restricted marine waters subject to a minimum of interference by other pollutorial loadings. San Diego Bay, California, meets these requirements and is eminently suited as a location for the study.

The study should be of such direction and scope as to suggest solutions to vessel waste problems that are applicable nationwide. The investigation should not be limited to determining the effects of vessel waste loadings on the receiving waters, but should also develop a method or methods of disposal which will protect the water quality of the marine environment.

- (2) An ecological investigation of San Diego Bay should be made in conjunction with the study on vessel wastes. This will provide baseline data on which to evaluate the effectiveness of water pollution control activities in general, and the control of waste discharges from vessels in particular.

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APPENDIX

1. Resolution 64-7, "A RESOLUTION REQUESTING THE STATE WATER QUALITY CONTROL BOARD TO MEMORIALIZE THE WATER POLLUTION CONTROL ADVISORY BOARD OF THE UNITED STATES DEPARTMENT OF HEALTH, EDUCATION AND WELFARE CONCERNING SEWAGE AND WASTE DISPOSAL FROM VESSELS," San Diego Regional Water Pollution Control Board, February 27, 1964.
2. Resolution 64-6, "CONCERNING THE PROBLEM OF WASTE DISPOSAL FROM SHIPS," California State Water Quality Control Board, April 8, 1964.
3. Resolution No. 1, "DISCHARGE OF WASTES FROM SHIPS," Federal Water Pollution Control Advisory Board, April 17, 1964.
4. Letter, Secretary, Department of Health, Education and Welfare to the Secretaries of Commerce, Treasury and the Navy, June 2, 1964.
5. Letter, Secretary of Commerce to the Secretary, Department of Health, Education and Welfare, June 16, 1964.
6. Letter, Secretary of the Treasury to the Secretary, Department of Health, Education and Welfare, June 8, 1964.
7. Letter, Secretary of the Navy to the Secretary, Department of Health, Education and Welfare, June 25, 1964.

C O P Y

C O P Y

C O P Y

STATE OF CALIFORNIA
SAN DIEGO REGIONAL WATER POLLUTION CONTROL BOARD

RESOLUTION 64 - 7

A RESOLUTION REQUESTING THE STATE WATER QUALITY CONTROL BOARD
TO MEMORIALIZE THE WATER POLLUTION CONTROL ADVISORY BOARD
OF THE UNITED STATES DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
CONCERNING SEWAGE AND WASTE DISPOSAL FROM VESSELS

WHEREAS communities in the San Diego metropolitan area have recently expended almost \$60,000,000 for the construction of unified waste transportation, treatment and disposal facilities intended to correct a number of water pollution problems coming under the jurisdiction of this Regional Board; and

WHEREAS the principal problem requiring the aforementioned program was that of pollution of San Diego Bay; and

WHEREAS, in accordance with the findings, objectives and criteria of Resolution 55-1 of the San Diego Regional Water Pollution Control Board, A RESOLUTION ENUNCIATING THE BENEFICIAL USES OF SAN DIEGO BAY WATERS TO BE PROTECTED AND ADOPTING WATER QUALITY CRITERIA PERTAINING THERETO, the following sewerage agencies did participate in construction of facilities for the purpose of terminating all municipal waste discharges to San Diego Bay: City of San Diego, City of National City, City of La Mesa, City of Chula Vista, City of El Cajon, City of Imperial Beach, City of Coronado, Palm City Sanitation District, Spring Valley Sanitation District, Lemon Grove Sanitation District, and the Rolando Sanitation District; and

WHEREAS the Naval Amphibious Base, Coronado, also has participated in the construction of facilities and is constructing additional facilities for the purpose of terminating its sewage discharge to San Diego Bay; and

WHEREAS with the completion of facilities connecting the Naval Amphibious Base to the San Diego metropolitan sewerage system in the near future, all sewage discharges to San Diego Bay from land sources will have been terminated; and

WHEREAS, at that time, the only remaining source of sewage discharged to San Diego Bay will be waste discharges from ships and vessels; and

WHEREAS, United States Navy ships moored and docked at various locations in San Diego Bay are the chief contributors of ships' wastes to San Diego Bay and all such wastes are discharged in the raw, untreated form; and

WHEREAS the discharge of raw ships' wastes into San Diego Bay does not conform to water quality criteria adopted by this Regional Board for the protection of the beneficial uses of said Bay; and

WHEREAS, several years ago, this Regional Board brought its concern about the ships' wastes problem to the attention of the Eleventh Naval District and has communicated with the United States Public Health Service on the matter, suggesting that the effect of ships sewage discharges upon San Diego Bay be studied, and that appropriate waste disposal facilities and procedures be developed and put to use; and

WHEREAS this Regional Board has been advised that a committee composed of representatives of various federal agencies -- The Committee on Sewage and Waste Disposal From Vessels -- was formed in 1960 and has been considering ways and means of alleviating the problem of raw sewage discharges from ships and sewage disposal criteria for American flag vessels; and

WHEREAS, with respect to control of pollution in San Diego Bay, this Regional Board is of the opinion that there is a need for an enlarged effort on the part of the Federal Government in conducting field studies of the problem and in development, practical demonstration, and installation of necessary shipboard and dockside equipment for control of waste discharges; and

WHEREAS it is evident to this Regional Board that the problem of discharge of raw wastes from ships occurs in many locations and is a matter of statewide and nationwide significance, which should receive the fullest attention of all agencies concerned; now, therefore, be it

RESOLVED that the San Diego Regional Water Pollution Control Board bring to the attention of the State Water Quality Control Board the problem of raw waste discharges from ships and vessels, including sewage and oily discharges, for appropriate action by that Board; and be it further

RESOLVED that the State Water Quality Control Board is hereby requested to memorialize the Water Pollution Control Advisory Board of the United States Department of Health, Education and Welfare, advising that Board of its concern about the problem of raw waste discharges from ships and vessels and petitioning that body to give attention to:

1. The need for field studies of the actual and projected effects of raw waste discharges from ships and vessels upon harbors and coastal waters;
2. The need for development, practical demonstration, and installation of shipboard and dockside devices, which will preclude the discharge of raw wastes into harbors and coastal waters and control the offensive conditions and hazards to beneficial water uses associated with such discharges;
3. Adoption of sewage disposal criteria for vessels within the near future; and be it further

RESOLVED that the State Water Quality Control Board inform the Water Pollution Control Advisory Board that:

1. All municipal sewage discharges into San Diego Bay have been terminated at a cost of approximately \$60,000,000 to communities participating in the program;
2. Over \$3,000,000 was contributed toward controlling pollution in San Diego Bay in the form of federal sewerage construction grants;
3. San Diego Bay waters are protected for such high-order beneficial uses as ocean water contact sports, and discharge of raw ships' wastes into said waters does not conform to the criteria and objectives of this Regional Board; and be it further

RESOLVED that, in view of the foregoing, the State Water Quality Control Board be requested to inform the Water Pollution Control Advisory Board that:

1. Resolution of the problem of ships' wastes discharges into San Diego Bay should be given highest priority among similar problems;
2. San Diego Bay is ideally suited for field studies of the actual effects of raw waste discharges from ships upon saline receiving waters; and be it further

RESOLVED that certified copies of this Resolution be forwarded to the State Water Quality Control Board, and to all known interested agencies or persons who may have need therefor or who may request same.

UNANIMOUSLY adopted this 27th day of February, 1964.

/signed/

J. B. Askew, M.D.
Chairman

I hereby certify that the above and foregoing is a full, true, and correct copy of Resolution 64-7 of the San Diego Regional Water Pollution Control Board, passed and adopted by said Board on February 27, 1964.

Dennis A. O'Leary
Executive Officer

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State Water Quality Control Board

RESOLUTION NO. 64 - 6

CONCERNING THE PROBLEM OF WASTE DISPOSAL FROM SHIPS

WHEREAS the San Diego Regional Water Pollution Control Board has by Resolution 64-7 requested the California State Water Quality Control Board to memorialize the Federal Water Pollution Control Advisory Board concerning the discharge of raw sewage from ships, including vessels of the United States Navy; and

WHEREAS the discharge of raw sewage to the waters of the State does not meet even the minimum requirements set for other discharges and for the control of pollution in these waters; and

WHEREAS Mr. William E. Warne, Director of the California Department of Water Resources and member of the State Water Quality Control Board, is also a member of the Federal Advisory Board; now, therefore, be it

RESOLVED, that Mr. Warne be requested to bring this matter to the attention of said Federal Board; and be it further

RESOLVED, that copies of this resolution and Resolution 64-7 of the San Diego Regional Water Pollution Control Board be sent to Mr. James M. Quigley, Chairman of the Federal Water Pollution Control Advisory Board, asking that the Secretary of Health, Education, and Welfare use his offices to work with the United States Navy and other Federal agencies concerned with this problem to work out a solution; and be it further

RESOLVED, that copies of this resolution be forwarded to Mr. William E. Warne and the San Diego Regional Water Pollution Control Board.

Adopted 4-8-64

C O P Y

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RESOLUTION PASSED BY THE
PRESIDENT'S WATER POLLUTION CONTROL ADVISORY BOARD

APRIL 17, 1964

The Board is aware that a danger exists to the health and welfare of the people from the discharge of untreated wastes from ships in U. S. ports. The people in the area of San Diego, California have installed costly facilities to protect San Diego Bay from pollution and to promote recreational use of its waters, yet ships of the U. S. Navy stationed in the Bay continue to discharge wastes into the Bay's waters. Such practices occur elsewhere in the United States and from commercial as well as military vessels. The Board requests the Secretary of Health, Education and Welfare to take cognizance of this situation and to use his good offices in soliciting the cooperation of the Department of the Navy, the United States Coast Guard and the United States Maritime Commission in joint efforts to eliminate this hazard.

I, ROBERT C. AYERS, Executive Secretary of the Water Pollution Control Advisory Board, do hereby certify that the above and foregoing resolution was adopted by the said Board at its meeting in Atlanta, Georgia on April 17, 1964.

Done and dated this 11th day of May, 1964, at Washington, D. C.

/s/ Robert C. Ayers
Executive Secretary

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June 2, 1964

Dear Mr. Secretary:

The President's Water Pollution Control Advisory Board at its meeting in Atlanta, Georgia, on April 17, 1964, passed a resolution concerning their interest in the dangers associated with the discharge of untreated wastes from vessels. A copy of this resolution is enclosed for your consideration and appropriate action.

We support the position of the Board in this matter and will cooperate with you to the fullest extent in carrying out the Board's recommendation.

Sincerely,

/s/ Anthony J. Celebrezze
Secretary

Honorable Douglas C. Dillon
Secretary of the Treasury
Washington, D. C.

Enclosure

WTBlair:rvm 5/20/64

cc: Mr. Krause
Mr. Ayers

Identical letters to Secretary of Navy and Secretary of Commerce.

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THE SECRETARY OF COMMERCE
WASHINGTON 25, D. C.

June 16, 1964

Dear Mr. Secretary:

Receipt is acknowledged of your letter of June 2, 1964, regarding the resolution passed by the President's Water Pollution Control Advisory Board at its meeting in Atlanta, Georgia, on April 17, 1964.

Although this Department has no direct responsibility for pollution prevention, steps have been taken by the Maritime Administration to assist United States merchant ships in pollution control measures. For instance, the Permutit Company, under contract to the Department, is engaged in final development and tests of an oil water separator for ships. We anticipate that this equipment will materially assist in preventing discharge of oily bilge water into harbors and adjacent waters.

Please be assured that the Maritime Administration, Department of Commerce, within the scope of its responsibilities, is working actively on measures to prevent pollution of our navigable waters.

Sincerely yours,

/s/ Luther H. Hodges
Secretary of Commerce

The Honorable Anthony J. Celebrezze
Secretary of Health, Education,
and Welfare
Washington, D. C.

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TREASURY DEPARTMENT
WASHINGTON, D. C. 20220

June 8, 1964

Dear Mr. Secretary:

Your letter of June 2, 1964 forwarded a copy of a Resolution passed by the President's Water Pollution Control Advisory Board for consideration and appropriate action. The Coast Guard stations three major floating units at San Diego, California, the largest being the 125-foot Cutter ALERT (25 men) and two 95-foot Patrol Boats (14 men each). The Patrol Boats which have pump type toilet facilities have or are in the process of being fitted with electro-chemical sewage treatment equipment which has been found to effectively treat wastes. The ALERT, an older vessel scheduled for replacement, offers a more difficult waste treatment problem and currently discharges raw sewage overboard.

However, the Treasury Department shares the concern of Federal and State agencies regarding the pollution of National waters. It is currently seeking solutions to the Coast Guard's problems afloat and ashore. The problem of vessels involves three areas. The first area is the one mentioned above where vessels have hand pump type toilet facilities. It is believed the electro-chemical treatment equipment when fitted to all boats and small vessels having this type toilet facility will eliminate these units as a problem. The group of vessels with a limited number of flush type toilets present more difficulty. At this time negotiations are in progress with a manufacturer of macerator-chlorinator sewage units for installation in two vessels for evaluation. One vessel will be stationed in an inland water area and the other will be a unit stationed on the sea coast. Should these evaluations prove satisfactory, a program for equipping vessels will be planned. Waste treatment on the larger classes of vessels offers the most difficult solution. These vessels have numerous sanitary facilities located in several places on each vessel. In order to make a start in solving the problem, a contract has been negotiated for furnishing a 60-man aerobic sewage treatment plan. It is planned to install this equipment in the main hold of a large buoy tender for evaluation. This installation should be completed later this year and will develop the scope of the problems on larger vessels both as to effectiveness and over-all cost. Pending the development of a satisfactory waste treatment procedure for larger vessels, designs for new construction are incorporating sewage holding tanks. These tanks will be used when the vessel is operating close to shore for ultimate discharge through shore systems or in the open sea.

The matter of waste disposal at Coast Guard shore establishments is near solution. A study made several years ago involving 594 Coast Guard shore facilities showed that 28 required corrective action. Such action has been taken with respect to 22; it is still pending on the other six.

As is apparent from the foregoing, the Coast Guard also fully supports the position of the President's Water Pollution Control Advisory Board. The Coast Guard will continue to work closely with the Public Health Service sanitary engineer stationed at Coast Guard Headquarters in solving these and other waste disposal problems.

Yours sincerely,

/s/ James A. Reed

The Honorable Anthony J. Celebrezze
Secretary of Health, Education,
and Welfare
Washington, D. C.

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DEPARTMENT OF THE NAVY
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

June 25, 1964

My dear Mr. Secretary:

This is in reply to your recent letter expressing your Department's support of the resolution passed by the President's Water Pollution Control Advisory Board at its April 17, 1964 meeting in Atlanta, Georgia, and offering to cooperate in carrying out the Board's recommendation. You enclosed a copy of the resolution, which states the discharge of untreated wastes from ships in U. S. ports constitutes a danger to health and welfare and requests that you solicit the cooperation of the Navy, the Coast Guard, and the Maritime Commission in efforts to eliminate this hazard.

The Navy appreciates the importance of reducing pollution in our rivers and harbors and for some time has been attempting to develop a satisfactory solution to this difficult problem. Our work includes active participation in work of your Department's Interdepartmental Committee on Sewage and Waste Disposal from Vessels. This Committee appears to be the logical organization for coordinating efforts to eliminate health hazards created by ship wastes. The Navy will be pleased to consider any plans for expanding the activities of this Committee.

As you may know, the Navy already has taken several steps to reduce the hazards from naval ship wastes. For years we have prohibited the discharge of garbage and trash into harbor areas; these are transferred to shore by barges. All new berthing and messing barges are equipped to discharge sewage directly to shore facilities and all new piers and drydocks are being equipped with facilities to handle sewage discharged from ships.

In addition, the Navy is studying means for shipboard treatment of sewage. The Bureau of Ships, which is responsible for designing and developing means for preventing river and harbor pollution by Navy ships, has investigated every available type of treatment device. I am informed that all have proven marginal in meeting the effluent criteria proposed by the Interdepartmental Committee. Moreover, all have been found to involve a totally unacceptable amount of space and weight. Since naval warships are critically short of space and can accommodate only limited non-military weights, it is evident that a significant break-through in treatment technology is necessary. As a first step toward achieving a break-through, the Bureau is collecting data on the biological, physical, chemical, hydraulic, and other

characteristics of sewage. The data will be used to establish techniques and design parameters for developing a system which, hopefully, will prove acceptable for use in naval ships. The Bureau anticipates that such a system will be available for evaluation by December 1965.

The Bureau of Ships is developing an interim small treatment system, using maceration and chlorination, for ships and harbor craft carrying fewer than 40 persons. Forty is the maximum number that the Inter-departmental Committee considers may use such a system. This system should be ready for evaluation by December 1964. The Bureau is also studying the feasibility of realigning drainage systems on existing ships to facilitate discharge to shore facilities.

As the foregoing indicates, considerable work has been accomplished in dealing with pollution by sewage from Navy ships, but much remains to be done. I can assure you that the Navy will continue its current efforts and its cooperation with other interested parties. I am not certain what more can be done at this time, but I will be pleased to consider any suggestions and proposals you may have.

Sincerely yours,

/s/PAUL B. FAY, Jr.
Under Secretary of the Navy

The Honorable Anthony J. Celebrezze
Secretary of Health, Education,
and Welfare
Washington, D. C.